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## THE GREAT CRESTED FLYCATCHER.

BY MRS. MARY TREAT.

LAST spring a pair of noisy great crested flycatchers abandoned their usual nesting place in the woods, and resolved to take up their abode among civilized birds.

It is only a few years since the wood pewee was first observed to leave the dark woods and nest around our dwellings. This little bird builds a neat compact nest which it glues fast to the limb of a tree, and lines it with some soft material. In Southern New Jersey it often uses the silky down of the cotton grass *(Eriophorum virginicum)* for a lining. It covers its nest externally with lichens, very much after the fashion of the hummingbird. This charming little flycatcher is now one of our most confiding, familiar birds. It will be interesting to learn if the great crested flycatcher has also concluded to become civilized, or is it simply a freak of one pair of birds?

Audubon says of this species, "The places chosen by the great crested flycatcher *(Myiarchus crinitus* Linn.) for its nest are so familiar, and the composition of its fabric is so very different from that of all others of the genus with which I am acquainted, that perhaps no one, on seeing it for the first time, would imagine it to belong to a flycatcher. There is nothing of the elegance of some or the curious texture of others displayed in it. Unlike its kinsfolk, it is contented to seek a retreat in the decayed part of a tree, of a fence rail, or even of a prostrate log moldering on the ground. I have found it placed in a short stump at the bottom of a ravine where the tracks of raccoons were as close together

as those of sheep in a fold. In all these situations our bird seeks a place for its nest, which is composed of more or fewer materials as the emergency may require, and I have observed that in nests nearest to the ground the greatest quantity of grass, fibrous roots, feathers, the hair of different quadrupeds, and the exuviæ of snakes was accumulated. The nest is under the above circumstances at all times a loose mass. Sometimes when at a great height, very few materials are used, and in more than one instance I have found the eggs merely deposited on the decaying particles of the wood, at the bottom of a hole in the broken branch of a tree, sometimes of one that had been worked out by the gray squirrel."

In "Wilson's Ornithology," we find the following with regard to the nesting habits of this bird: "The great crested flycatcher arrives in Pennsylvania in May and builds his nest in a hollow tree deserted by the blue-bird or woodpecker. The material of which this is formed is scanty or rather novel. One of these nests now before me is formed of a little loose hay, feathers of the guinea fowl, hogs' bristles, pieces of cork, snake skins and dogs' hair. Snake skins with this bird appear to be an indispensable article, for I have never found one of his nests without this material forming a part of it. Whether he surrounds his nest with it by way of terrorism to prevent other birds or animals from entering, or whether it be that he finds its silky softness suitable for his young, is uncertain; the fact, however, is notorious."

So it seems that heretofore the great crested flycatcher has been content with any old tree or stump that afforded him a cavity into which he could gain access. But now the little bird-houses in the vineyard, scattered about on the posts, attract his attention much to the chagrin of the bluebirds and wrens. Apparently unconscious of this, the pair proceed with their house hunting much after the fashion of human bipeds.

The male stations himself on one of the little houses, and with his harsh voice calls his mate. She comes and inspects the house, but seems to have some objection, so they go the rounds, even looking into those already occupied by bluebirds, but they do not molest them.

A male bluebird is watching the pair from an adjacent grape post as they visit his home. The flycatcher is stationed on the

top of the house and screaming for his mate. She comes and merely looks in and finds the female on the nest and immediately flies away, but the male stays awhile and continues to call, evidently thinking that she did not half look at the house, but she does not return, and as he flies away, the bluebird who was watching him at a safe distance, now courageously flies after him and then returns to his mate who meets him at the door, and they chatter over the matter in their low, sweet way, he apparently telling her how he has driven the hateful fellow away!

The flycatchers next visit a little house fastened to the railing of an upper piazza, but this tqo is occupied by a family of bluebirds, and they leave them unmolested. At last madam flycatcher chooses the finest establishment on the premises—a three-storied octagon house surmounted with a cupola and spire, with a weather vane and ball attached to the spire. The house is fastened to the top of the stable, and was originally intended for the martins, but a pair of bluebirds were the first to occupy it, and they have held it for several years past, allowing no other bird to get possession; but they do not try to drive the flycatchers, who finally select the cupola which they find empty.

They are beyond my reach but they do not try to prevent my seeing the material which the female carries to the house. On the contrary they seem wholly indifferent to my presence, much more so than our familiar bluebird.

The male always precedes his mate and heralds her approach with a clamorous noise. He stations himself on the ball or weather vane above the cupola, and seems to be giving directions to his partner in a very loud voice, while she works with a perverse stick that she cannot get through the door.

She selects a stick longer than the door, and stupidly holds it about midway and tries to force it through. If it is too stout to bend or break, she works long and laboriously, while her partner looks on and screams. At last, discouraged with the hopeless endeavor, she comes to the ground and selects another. She proceeds in this way for several hours. Finally she learns to put the stick end first through the door, and now the work progresses rapidly.

They are gone longer than usual, so long that I begin to fear they have given up their elegant site, but in a few hours I again hear the harsh voice of the male, and on looking up, see the

female following her mate with a streaming banner, which proves to be the indispensable snake skin.

Whether this bird, like its little congener, the wood-pewee, has at last concluded that its nest will be more safe near the habitations of man, remains to be seen.

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## THE REASONING FACULTY OF ANIMALS.

BY JOSEPH F. JAMES.

MUCH as has been written on the subject of instinct and reason in animals, the question as to whether they possess reason is nearly as far from being answered as ever, and people continue to write and argue with the same pertinacity as of yore. Some writers have maintained that all the actions of animals lower than man, are performed by a something designated as instinct, and that this was a faculty given by Divine power to animals, to take the place of reason possessed only by mankind. Others have said that both animals and men have reasoning powers, but the former in such a limited degree as to be hardly noticeable. Still others contended that animals were actuated to a very great extent in their actions by reasoning faculties, and that entirely too much stress has been placed upon the power of instinct;[1] while a last party have said that neither man nor beast is possessed of reason, but that both perform all their actions automatically, and being under the influence of unchangeable law, do what they do because they cannot do otherwise.[2]

In the olden time, before we knew as much about the animal world as we do now, the unerring faculty of instinct was expatiated upon times without number. All animals were set down as without reasoning powers, and when one did perform an action out of accordance with its usual life, it was looked upon as a most remarkable phenomenon, and as instinct working in an abnormal direction. Besides, this instinct was thought to be bestowed by the Deity, directly upon the animal. In later days

[1] The latest book taking this ground is "Mind in the Lower Animals," by W. Lauder Lindsay, 2 vols, 1880.

[2] Descartes' idea of animated machines. It has for its strongest supporter Professor Huxley. See article "Are Animals Automata?" by T. H. Huxley in *Popular Science Monthly*, v, 724.

this is not so much the case, and many consider that the sooner we discard the idea of instinct, and the sooner we attempt to explain the actions of animals upon the theory of their possessing reason, just that much sooner will we be able to come to a just conclusion.

It can hardly be denied that there are some actions, which, instinctive in the ordinary sense, are transmitted from one generation to another, and are performed by all alike. Let us see if we can not find a reasonable ground for the first introduction of some of these instincts.

There was a time when the first mud wasp stung its first spider or grub, and deposited it in the first nest for the use of its young. But how do we know that this action was performed as successfully by the first female wasp, as it is now by her descendants? Would it not be just as reasonable to suppose that the present perfection of this action, if it be perfect, was the result of long experience, and of a gradual improvement from generation to generation, as to imagine that the first wasp succeeded as well as her descendants do now? There was a time when the first chicken was hatched and scratched the ground. But is it necessary to suppose that the first born of the jungle-fowl of India acted as our barnyard fowls do now, to account for the ability of the new born chicks to run over and scratch the ground? Not so. These actions, and perhaps many more, are hereditary faculties, imperfect and crude at first, but gradually improving and perfecting, and transmitted from generation to generation in the same way as a taste for engineering, a liking for science, or ambition to be a soldier, descends from father to son. The gradual development of the mind of animals and of man, is under the influence of the same laws as the development of the body.

It is probable that the first pair of jungle-fowls of India, way back in antediluvian times, hatched a brood of young ones, which stayed in the nest till fully fledged, as do the young of most all birds. Suppose an accidental event occurred, which made it advantageous for the young chick to be able to run and scratch as soon as it broke out of the shell. Suppose it was found by nature, that the chick that could run away soonest after being born, would be the one most likely to escape from the clutches of the hawk when the mother was driven from the nest. The additional safeguard of life would be seized upon, and by

gradually strengthening the ability to run, it would be transmitted in an improved form through the birds which escaped by running, to their descendants, and finally be bequeathed to their posterity in the form in which we now find it. Such an explanation would apply to quail and grouse, and, in fact, to all birds which run as soon as hatched, and seek to hide themselves from their enemies in the grass and bushes. This instinct in young chickens is by no means so perfect as it might be; for any one who has noticed them when just hatched, and led by the hen, will have seen that they stumble and stagger, sometimes going head over heels in their efforts to pick something up. So that even if it were instinct, it is perfected by practice.

Then again with the wasp. The one which provided best for its offspring, would leave the most descendants; and the faculty and the ability to provide would be transmitted from generation to generation, being improved each time by the natural laws of modification with descent, and by the struggle for existence. So with the cells of the bee. Mathematicians have been struck with astonishment, and held up their hands in holy wonder, to see such an insignificant insect as a bee making a cell more mathematically accurate than they can after a lapse of 2000 years.[1] But it was a matter of necessity to use as little material and occupy as little space as possible with his cells. The ancient bees doubtless made their cells much less mathematically correct than the present ones are supposed to do.[2] And it was only when the use of less wax, and of less space, gave one hive the advantage over another in the struggle for existence, that the present cell began to appear. It was not made so because of the instinct of the bee, but because the laws of nature compelled it to be made so, if the bee would hold its own in the struggle. We know well that bees do not make their cells always exactly alike, nor as exactly hexagonal as we are often told. They depart from the regular shape,[3] and use other forms to suit circumstances, and we have here a

[1] Lord Brougham, "Dialogues on Instinct," 1844, pp. 66–70.

[2] Even the cells of the present hive bee are by no means perfect. In fact, investigations by Professor Wyman, printed in the Proceedings of American Academy of Arts and Sciences, VII, 1866, have proved "that the cells are all more or less imperfect, and that an hexagonal cell, mathematically exact, does not exist in nature, but only in theory." Packard, "Guide to Study of Insects," 1869, pp. 123–127, which see for an extended notice of Professor Wyman's paper.

[3] See Kirby and Spence, "Introduction to Entomology." Lond. ed. II, 469.

clear evidence of reasoning powers, and of the faculty of adapting means to ends.

Again we are told that many insects lay their eggs upon the leaves of certain plants, upon which the larvæ feed, and upon no others, and it is pointed out as a case in which the Almighty has endowed the creature with an instinctive knowledge of the plant. But why should it be so? The white butterfly lays its eggs upon the cabbage, and the larvæ feed upon its leaves. What right have we to say that the butterfly does not know the cabbage? There may be something about that plant agreeable to her olfactory nerves, which induces her to alight and deposit her eggs. Or it may be that in ancient days, and must have been, that the butterfly deposited her eggs upon any plant indiscriminately. If those that fed upon the cabbage throve better than those on some other plant, they would be preserved in the struggle for existence, and leaving more descendants than their rivals, would thus transmit the habit of frequenting more and more the cabbage plant. Perhaps at the time some species of insects originated, the ancestor of all deposited her eggs upon any plant most convenient. All may not have been suitable, but the larvæ throve on those that were, and frequented the same plant afterwards; and thus in feeding on different plants and leading different lives, the one original species became differentiated into distinct but allied species.

The instinct which induces the cuckoo to lay her eggs in the nests of other birds, can be shown to have arisen in much the same manner as those to which we have referred. Mr. Darwin gives an excellent account of how the instinct might be developed. He says: "Now let us suppose that the ancient progenitor of the European cuckoo, had the habits of the American cuckoo, and that she occasionally laid an egg in another bird's nest. If the old bird profited by this occasional habit through being able to migrate earlier, or through any other cause; or if the young were made more vigorous by advantage being taken of the mistaken instinct of another species, than when reared by their own mother, encumbered as she could hardly fail to be by having eggs and young of different ages at the same time; then the old birds or the fostered young ones would gain an advantage. And analogy would lead us to believe, that the young thus reared, would be apt to follow by inheritance the occasional and abber-

rant habits of their mother, and in their turn would be apt to lay their eggs in other birds' nests, and thus be more successful in rearing their young."[1] This explanation seems to us simple, and at the some time adequate, and the same process of reasoning applied to all instincts of like character, would with little modification be sufficient. Such instincts as the last, the hive bee cells, the case of butterflies laying eggs on plants, the slave-making habits of ants, and many more which will recur to any one, are brought into existence accidentally, and given a tendency to variation in any faculty of the mind or power of the body, and we can expect to see it modified by nature's seizing upon the favorable variations, transmitting them in an improved state each time by inheritance from one generation to another, until they reach such perfection that men are astonished, and can see no other way of accounting for the fact, but by bringing to their aid divine power and intervention.

Now we are told, that instinct is some power or principle possessed by animals, by means of which they perform, blindly and ignorantly, works of an intelligent nature; further, an impulse by which they are directed, without previous instruction or experience, to do unerringly what is necessary for the preservation of the individual or the species. The fact that instincts are not unerring, goes far to prove that they had some such origin as we have described. It is known, for instance, that butterflies and moths often lay their eggs upon plants or in positions where their larvæ can not flourish.[2] What is this but a return to a former method of proceeding, when the insect laid her eggs on any plant? Here the instinct fails utterly, and not only does not assist in the preservation of the species, but is instrumental in destroying it. Cattle are supposed to know by instinct poisonous from beneficial plants, but take them to a new country, and they at first are as likely to eat the poisonous ones as those that are not. Their so-called instinct fails, because it is not an instinct at all, but the result of experience and observation. The instinctive dread birds have of man is often spoken of; but that is no instinct either. Birds and animals of all kinds in a state of nature, where

[1] Origin of Species, 6th ed., N. Y., p. 212.

[2] Kirby and Spence, loc. cit. II, 466, say that the flesh fly sometimes lays her eggs in the flowers of *Stapelia hirsuta*, instead of in carrion, and further that the common house fly will frequently deposit her eggs in the snuff in a box.

they have never been molested, or disturbed but little, have no great dread of man, and it is only after they have learned by dire experience, and by observation, the evils likely to fall upon them from the advent of man, that they show any dread or fear of him.[1] This dread is then transmitted to their offspring, but is by no means an inherent faculty of the birds' or animals' mind.

It is said again that a marked instinct is shown in birds by their nest building. Some say the bird makes as good a nest the first time she tries, as when she becomes old and experienced. But this has been emphatically denied, and is doubtless untrue. An observer has given an account of the first and subsequent attempts of one pair of birds to build a nest; and he shows conclusively that the first was a poor specimen of bird architecture, the second was an improvement, the third still better, and so on until the art was finally reached of making a handsome and serviceable nest. Alexander Wilson, one of the best of ornithologists, believed implicitly that birds improve in nest building and gives several instances of it.[2] Birds learn to sing, too, by a long apprenticeship. At first the song consists merely of a few disconnected notes. By continual practice the art is developed, and at last the bird carols forth the lay which delights all hearers.[3] It is not the result of instinct, but of practice and gradual improvement. Mr. Wallace believes that as man performs many of his intelligent acts merely by imitation, so it is with birds in making a nest.[4]

One would think that if there is any action which is instinctive with water animals, it would be that of swimming, yet this is not always the case. A writer in *Harper's Weekly* stated that "were a young seal taken three or four weeks after birth and thrown into

[1] See Darwin's Voyage of Naturalist, pp. 398–401. In speaking of the birds of the Galapagos islands, he says: "A gun is here almost superfluous, for with the muzzle I pushed a hawk off the branch of a tree. One day whilst lying down, a mocking thrush alighted on the edge of a pitcher, made of the shell of a tortoise, which I held in my hand, and began very quietly to sip the water; it allowed me to lift it from the ground whilst seated on the vessel." The testimony of other travelers is corroborative.

[2] American Ornithology (16mo, Edinburgh edition, 4 vols. 1831), I, 179, 189–190 See also article by Dr. Brewer, "On Variation of the nests of the same species of Birds." AM. NAT. XII, 35. Wallace, "Contributions to Natural Selection," p. 227. Article from "Revue des Deux Mondes" in *Pop. Sci Monthly*, II, 485, and others.

[3] Darwin's "Descent of Man," 1st. ed., I, 53 and 54. Wallace, ibid, p. 220, et seq.

[4] Wallace, ibid. "Essay on Philosophy of Birds' Nests."

deep water, it would drown miserably in a few minutes; they begin to grow accustomed to the water at the end of three or four months by degrees, and it takes a pup about three weeks' practice at the surf margin before it can handle its flippers properly in the water." Here instinct is out of the question, for to be that, the ability to swim would be manifested almost at birth.

We have granted that some animals are possessed of instincts, but we deny that these are implanted by divine agency, and contend that they come into existence in obedience to natural laws. We contend also that outside of these instincts proper, animals of all classes, from insects[1] up to monkeys, perform acts which are certainly analogous to those performed by the human mind, and which ought to rank with the reason of man. Reason, we are told, is the power by means of which one proposition is deduced from another, and of forming a conclusion from known premises. Now if it could be proved that animals are possessed of feelings of love, hate, jealousy, grief, kindness, memory, and many other human traits; that they can distinguish right from wrong; if it could be proved that they are capable of drawing conclusions from known premises; and that they can and do follow out a train of reasoning; then it would be proved beyond all peradventure that they do have reason, and to a very marked degree.

There are thousands of anecdotes relating to all classes of the animal kingdom showing in a greater or less degree the reasoning faculty. It is obviously impossible to give anything like all of them here, and a few of the more striking and relating to the principal classes, will serve to point our moral and adorn our tale.

Of the Articulates, the Crustacea are considered low in the scale, yet instances showing reason are recorded of them. Darwin[2] tells us of a shore crab seen in Brazil by Mr. Gardiner. The animal was making its burrow in the sand, and Mr. G. threw some shells toward it. One of them rolled in, and three others lodged on the edge. The crab in about five minutes, brought out the shell, and carried it off about a foot and dropped it. Returning

[1] Lindsay in his "Mind in the Lower Animals" says that even in the Protozoa we find manifestations of purpose. That, in fact, all the orders of the Invertebrata are possessed of intelligence, foresight and reason to a greater or less extent. This is especially the case with ants. I, pp. 52–68.

[2] Descent of Man, 1st ed., I, 325.

and seeing the three other shells near the edge of his burrow, and apparently thinking that they too might roll in, he carried them off one by one, and deposited them with the other. Did not this animal reason on the subject in the same manner as a man would? Most decidely so. Hermit crabs have been seen to rob one another of their shells. A big one was once seen to give chase to a little crab with a shell much larger than his own. "The little one, apparently quite alive to the sinister intentions of his pursuer, took to flight as quickly as possible, and his attempts to escape were continued with the utmost vigor until further effort was hopeless. * * * At length he was overtaken, and then a regular pitched battle ensued. The little one resisted manfully, but was finally overcome, the more bulky opponent having, after the most strenuous exertions, succeeded in forcing his claws between the body of his weaker opponent, and his shell, and with the most frantic exertion turning him out. They then, apparently as a matter of course, exchanged shells, the ousted tenant yielding submissively to his fate, and quietly adapting himself to his reduced circumstances."[1] Suppose a man with boots too small for him, saw a little man with boots much larger than his own. Suppose society in such a state as to allow the big man to rob the little one of his boots, and leave his own for the use of the other. Would the man act by reason or by instinct? The answer is obvious.

Insects are higher than crabs in the animal creation, and among them we find the best developed instincts with a high degree of reasoning. Take for instance the ants. They live in communities, and some obey while others command; some work while others direct, so they must have a method of communicating ideas;[2] they recognize their comrades after being separated from them for months,[3] and therefore have memory; and language and memory are two of the highest gifts of man's mental nature. Bees can distinguish one kind of flower from another;[4] they bite holes in the base of the corolla to get at the honey when it is too

[1] Wood's "Man and Beast." N. Y., 8vo ed., p. 95.

[2] Sir J. Lubbock in AM. NAT., x, 156, et seq. Also note in *Pop. Sci. Mon.*, IX, p. 252. Article on "Habits of Ants" in *Pop. Science*, XI, 39.

[3] Huber, "Recherches sur les Fourmes," quoted in Kirby and Spence, l. c., II, 66. Lubbock, ibid, X, 154.

[4] Darwin, "Cross and Self Fertilization in Vegetable Kingdom," p. 416.

far for them to reach from the top, and when the hole is once bitten will always seek it;[1] thus one individual takes advantage of the labor of another. They can alter the shape of the cells of their hive to suit circumstances.[2] They are compelled to learn how to distinguish the situation of their hive when moved to a new place by circling round and round in the air and taking mental notes of its position;[3] and it is only after observation, experience and practice, that they can fly directly to the entrance. Wasps learn the position of their nests in the same manner. They are capable of being tamed and of recognizing their masters,[4] as are also butterflies. In districts where some species of dung beetles are found, they have the habit of depositing eggs in pellets made of horse or cow manure; but in districts where sheep are kept, instead of making the pellets, the insects use the pellet shaped excrement of these animals.[5] Beetles assist one another in their work and communicate ideas.[6]

If it seems unreasonable to say that an insect, without any distinct brain and nothing but a system of ganglia, can reason in such a manner, we might ask, what do you know about the mental powers of insects? How can we gauge their sight and compare it with ours, when their eyes have often hundreds of facets?[7] Or know aught of their feelings when we know that some feel with their antennæ?[8] Or anything about their hearing, when some hear with their antennæ, some with their fore legs, and some with their wings?[9] We don't know anything about it, and perhaps never will.

Many stories are told of the actions of toads. They can be easily tamed, will feed out of one's hand, and come at a call. Here is an anecdote of one. A lady was sitting in a garden,

[1] Huber, Linn. Trans., VI, 222, quoted by Kirby and Spence, l. c., II, 516. Darwin, ibid, pp. 426, et seq.

[2] Kirby and Spence, l. c., II, 475-489.

[3] Huber, Recherches, p. 100, quoted by Kirby and Spence, l. c., II, p. 520.

[4] Sir John Lubbock's tame wasp has become historical.

[5] Kirby and Spence, loc. cit., II, 469, quoted from Sturm's Deutschland's Fauna, I, 27.

[6] Kirby and Spence, loc. cit., II, 519, quoted from *Illiger's Mag.*, I, 488.

[7] "The number of facets or corneæ vary from 50 (in the ant) to 3650, the latter number being counted by Geoffroy in the eye of a butterfly." Packard, l. c., p. 25.

[8] Packard, loc. cit., p. 26.

[9] Wallace, Contributions, loc. cit., p. 202.

when she saw a large toad moving along the base of a wall, and examining it most systematically. He raised himself on his hind legs, peered into a crevice first with one eye and then with the other, and pushed his paw into the aperture. Apparently dissatisfied, he continued his operations and examined another, and then a third. This last seemed to satisfy him, and slowly drawing himself up he disappeared into the crevice. He evidently knew his own size and selected a hole big enough to crawl into without effort.[1] All fishermen know how difficult it is to induce an old trout to take the fly, and when hooked how successful he often is in tangling the line, or snapping it off against roots or stones. He has gained by long experience a knowledge of the traps set for him by man, and uses his knowledge in keeping out of the snares, and breaking away when caught. He has sense enough to know the danger he is in, and reason enough to keep out of it.

In respect to the reasoning powers of birds, there are so many anecdotes that it is difficult to make a selection. Every one knows how easily many birds are tamed; the crow or raven for instance, and above all the parrot, and how cunning they are in hiding any article they wish to keep to themselves. Swallows know that the hawk is their enemy, and sometimes take great delight in pestering him. Dashing forward as if immediately into his claws, then suddenly swerving off and enjoying the discomfiture of their enemy, who thought to have a feast. A swallow had become entangled by the leg with a string. His cries attracted some companions, and after a consultation they conceived a method of releasing the captive. They commenced to fly past the bird one after the other, each pecking at a certain point on the string as he passed, until it was cut in two, and the bird freed from bondage. A story is told of a goose and a hen. The latter hatched out some duck eggs, and of course the ducklings wished to take immediately to the water. The hen objected seriously, but without avail, and while she was mourning over the obstinacy of her brood, a solitary goose swam up, and with a noisy gabble took charge of them. After piloting them up and down for a while, they were turned over to their foster mother. Next day the same scene was repeated. This time the goose came close up to the bank, and without further parley the hen jumped on her

[1] Wood, Man and Beast, loc. cit., p. 23.

back and sailed about while the ducklings were enjoying their swim. This took place day after day, until the ducks were large enough to take care of themselves.[1] A gentleman busily at work in his garden had his attention attracted by a robin, who was acting in a curious manner. Feeling some curiosity to know what was the cause, he followed the bird and was led directly to her nest. There he saw a black snake which was in the act of robbing the nest. After the snake was killed, the bird showed great joy; flew down and pecked at the dead animal with every appearance of hatred, and then lighted on the gentleman's arm and poured forth her delight and gratitude in song.

With respect to mammals, it is hardly possible to see how any body can deny that they often reason. Who can not think of instances of the intelligence of dogs? or of a horse? or of the elephant? A very few anecdotes must here suffice. A retriever was observed by a workman busily collecting grass and leaves and carrying them in his mouth to one place. On examining the spot he found a hedgehog closely rolled up. When the dog had collected a sufficient quantity of grass to prevent the spines wounding him, he took the bunch in his mouth and trotted off. Darwin[2] tells a story of another retriever which most conclusively shows reason. "Mr. Colquhoun winged two wild ducks, which fell on the opposite side of a stream. His retriever tried to bring over both at once, but could not succeed; she then, though never before known to ruffle a feather, deliberately killed one, brought over the other, and returned for the dead bird." He also quotes Rengger in regard to American monkeys. Rengger states, "that when he first gave eggs to his monkeys, they smashed them, thus losing much of their contents; afterward they gently hit one end against some hard body and picked off the bits of shell with their fingers. After cutting themselves only once with any sharp tool, they would not touch it again, or would handle it with the greatest care. Lumps of sugar were often given them wrapped up in paper, and Rengger sometimes put a live wasp in the paper, so that in hastily unfolding it they got stung; after this had once happened, they always first held the packet to their ears to detect any movement within."[3] A baboon in London had the habit of

[1] Wood, Man and Beast, loc. cit., p. 49.

[2] Descent of Man, 1st ed., I, p. 46.

[3] Descent of Man, 1st ed., I, 45, 46.

adopting animals. Once a young kitten scratched him. He was astonished and looking at the kitten's paws, immediately bit off the claws. Animals, monkeys especially, use sticks and stones as instruments and weapons. A party of baboons in Africa were attacked by men at the entrance of a narrow pass in the mountains. The animals were up on the mountain side, and rolled the stones down into the pass so thick and fast that for a time it was completely blockaded. The orang in Borneo knows how to handle and throw sticks in the same manner, and even makes himself a bed in the tree to sleep at night, covering his head with leaves.[1] Humboldt refers to the horses and mules used in crossing the Andes. "Thus the mountaineers are heard to say, 'I will not give you the mule whose step is the easiest, but the one which has the most intelligence.'"[2]

It is hardly possible in the limits of an article like this, to do justice to our subject, but we are sure that what little has been said, will show to a fair and impartial reader, that animals certainly do possess a large amount of reason. There may be those who prefer to think that instincts are given to animals in a perfect form, by the Almighty. These seem to think that in taking the matter out of the Creator's hands directly, and placing all animal life under the control of natural laws, that we thereby detract from His power. But not so. For He made the laws by means of which animal life has progressed on the globe, and after the establishment of these laws, He holds Himself aloof from interfering. It is more degrading to the grandeur of the Infinite to suppose He has been compelled to interfere constantly with the works of His hands, than to suppose that He has, in the first place, established laws immutable and unchangeable, and endowed the first germs of life with the possibilities which have led to such grand results as are visible in the animal kingdom.

[1] Wallace, Malay Archipelago, N. Y. ed., p. 52, 70.

[2] Travels in Equatorial Regions of South America, I, 249.

# PROGRESS OF ANTHROPOLOGY IN AMERICA DURING THE YEAR 1880.

BY PROFESSOR OTIS T. MASON.

THE definition given to anthropology in the last year's sketch, published in the NATURALIST, May, 1880, is still retained. And the restricted area of this summary must also preclude any reference to the vast body of literature which has accumulated upon this subject in all the civilized countries of Europe. By American anthropology, however, we would be understood to mean both the subjective and the objective view of the term—publications (1) upon the anthropology of the American races, wherever they may have been printed, and (2) works by American anthropologists, whatever may have been the special branch of the science upon which they wrote.

The subdivisions of anthropology are somewhat arbitrary; indeed, those adopted here represent specialists rather than sharp lines of scientific demarcation. It is very convenient, however, to group the titles of papers in the following order:

I. Anthropogeny.
II. Archæology.
III. Biology.
IV. Comparative psychology.
V. Ethnology.
VI. Linguistic anthropology.
VII. Technology.
VIII. Sociology.
IX. Religion.
X. Instrumentalities.

I. *Anthropogeny.*—The appearance in an English translation of Ernst Haeckel's "Genesis of Man," during the year 1879, marked an epoch in anthropology. No such contribution to ontogeny and phylogeny appeared in 1880, but the statements of Haeckel have been taken up in detail, examined, attacked and defended with great spirit.

American scholarship continues to occupy a very humble rank in this department of our subject, as the following titles will show:

GILL, THEODORE—(Washington, D. C.) On the Zoölogical Relations of Man. Tr. Anthrop. Soc., Washington. I, p. 15. [A résumé of the doctrine of evolution.]

HOLMES, NATHANIEL—(St. Louis, Mo.) Geological and geographical distribution of the human race. Tr. Acad. Sci., St. Louis, IV, 1. [A summary.]

PARKER, DR. A. J.—On the brain of a Chimpanzee. *N. Y. Med. Record*, Jan. [An original investigation.]

WARD, LESTER F.—(Washington, D. C.) Pre-social Man. Tr. Anthrop. Soc., Washington, I, 68. [An application of the doctrines of Haeckel to the origin of intellectual and social phenomena.]

WINCHELL, ALEXANDER (Ann Arbor, Mich.)—Pre-adamites; or a demonstration of the existence of men before Adam: together with a study of their condition, antiquity, racial affinities and progressive dispersion over the earth. Chicago: S. C. Griggs & Co., 1880, 1 vol., pp. 500, with charts and illustrations. 8vo. [Outside of its controversial aspect, a valuable contribution to anthropology.]

II. *Archæology.* — The subject of archæology is a favorite among the divisions of anthropology in America. The Smithsonian Institution, conjointly with the National Museum, represents the country at large. In Massachusetts the Archæological Institute of America, the Peabody Museum, and the American Antiquarian Society have all made most valuable contributions to archæological knowledge. In New York city the American Museum of Natural History is making rich collections. Mr. Terry's fine private cabinet is now on exhibition there. Nothing is published by them as yet. The Philadelphia societies are not idle in the matter of archæology, although they have lost an earnest worker in Professor Haldeman. The Bureau of Ethnology at Washington, under the direction of Major J. W. Powell, while engaged more especially in the living problems of humanity, has made very exhaustive investigations relative to the Pueblos. The Anthropological Society of Washington has published its first volume of Transactions, which, although bearing date of 1881, is really a part of the work of 1880.

Proceeding westward, we find the Western Reserve Society of Cleveland, the Cincinnati Society of Natural History, the Madisonville Literary and Scientific Society doing excellent work in Ohio. The St. Louis Academy of Missouri and the Davenport Academy of Iowa are not a whit behind the older societies of the East in their zeal and efficiency. In several of the Western States, notably Indiana, Wisconsin and Minnesota, the State geological and statistical reports contain much that is valuable in archæology.

Nor is this all; private wealth is lavished upon local museums so indiscriminately, that frauds begin to multiply unpleasantly. In the discussion of instrumentalities, a catalogue of journals

publishing archæological papers will be given. The following is a list of papers and works published upon the subject:

ABBOTT, C. C. (Cambridge, Mass.)—Flint Chips. Peabody Mus. Rep., II, pp. 506–520.

Aboriginal remains in the valley of the Shenandoah river. *Science*, p. 262.

AMEGHINO FLORENTINO—Armes et instruments de l'homme préhistorique des Pampas. *Rev. d'Anthrop.*, 1880, pp. 1–12.

American Antiquarian Society Proceedings, No. 75 and No. 76. [Papers by Valentini on Mexican paper and on the Landa alphabet.]

American Antiquarian. [Published by the Rev. S. D. Peet, with a corps of able assistants. Archæological papers by Babbitt, Beauchamp, Brown, Hovey, Love, Peet and Whittlesey.]

Anales del Museo Nacional de Mexico. [Papers on Mexican antiquities, by Chavero, II, 1–46, 107–126, illustr. Anales de Cuauhtitlan, appendix, pp. 1–32.

BACON, A. T.—The ruins of the Colorado valley. *Lippincott's Mag.*, Nov.

CASE, THEO. S. (Kansas City, Mo.)—An excursion to the birthplace of Montezuma. *Ks. City Rev.*, Nov. [This periodical devotes a great deal of space to archæology and other branches of anthropology.]

CHARNAY, DÉSIRÉ—The ruins of Central America. *No. Am. Rev.*, Sept., Oct., Nov., Dec., 1880. [This expedition, fitted out by Pierre Lorillard, of New York, in conjunction with the French Government, represents a phase of archæology, which may be called the Prescott School, against which Mr. Morgan and those who agree with him, are working.]

COLLETT, JOHN—"A Vincennes mound" and "The Worthington mound." Indiana Rep. of Stat. and Geol., 1880, pp. 387–396.

DAWSON, J. W. (Pres. McGill College, Montreal)—Fossil men and their modern representatives. An attempt to illustrate the character and condition of Prehistoric men in Europe by those of the American races. Montreal, Dawson Brothers, 1880. 1 vol., VIII, pp. 348, illustr., 12mo. The same author has also published "The chain of life in geological time," and "The antiquity of man and the origin of species."

FARQUHARSON, R. J (Davenport, Iowa)—Prehistoric trephining in America, and The contemporaneous existence of man and the mastodon in America. A. A. A. S., Boston, 1880.

GANNETT, H.—Prehistoric ruins in So. Colorado. *Pop. Sci. Month.*, March.

HAINES, HENRY W.—Fossil man. *Pop. Sc. Month.*, Jan.

KERR, W. C.—The mica veins of North Carolina. Tr. Am. Inst. Min. Engineers, Feb., 1880.

LEWIS, H. C.—Antiquity of man geologically considered. *Science*, Oct. 16. See also Proc. Acad. Nat. Sc. Philad., Nov. 24, 1879, for a discussion of the antiquity of the Trenton gravels.

LOW, CHARLES F.—Archæological explorations by the Literary and Scientific Society of Madisonville, O., Part III, Jan. to June 30, 1880.

MACADAMS WILLIAM (Otterville, Ill.)—Antiquities of Western Illinois in several journals. A full list in Smithson. Rep. for 1880.

MACLEAN, J. P.—Mastodon, mammoth and man. R. Clarke & Co., Cin. See also *Universalist Quarterly*, July.

MORGAN, LEWIS H.—Description of an ancient stone pueblo on the Animas river, N. Mex, with a ground plan. Rep. Peabody Mus., II, 536–556. [In the first Report of the Archæological Institute of America, Boston, Mr. Morgan defines minutely his views with reference to the significance of the architectural features of the stone structures of Mexico and Central America.]

MORSE, EDWARD S.—The Omori Shell-heaps. *Nature*, April 15, 1880. Japanese Archæology. *Am. Naturalist*, September. Dolmens in Japan. *Pop. Sci. Month.*, March.

POTTER, W. B. and EDWARD EVERS—Contribution to the archæology of Missouri, by the Archæological Section of the St. Louis Academy. Part I. Pottery. pp. 30, 5 maps, 24 plates. 4to. [A work of great beauty and solid merit.]

RICE, A. THORNDIKE—Ruined cities of Central America. *N. A. Review*, Aug. [Introduction to M. Charnay's articles.]

SHORT, JOHN T.—The North Americans of antiquity; their origin, migrations and type of civilization considered. N. York, Harper & Brothers, 1880. 1 vol., pp. 544, illustr., 8vo.

Smithsonian Report of 1879, published in 1880. Archæological papers on Montana, P. W. Norris; Arizona, R. T. Burr; Wisconsin, Thos. Armstrong, W. G. Anderson; Iowa, Samuel B. Evans, R. N. and C. L. Dahlberg; Missouri, G. C. Brodhead; Illinois, Theron Thompson, A. Toellner, A. Oehler, Brainerd Mitchell, W. H. Adams; Indiana, Edgar R. Quick, F. Jackman; Georgia, Chas. C. Jones, Jr.; Alabama, W. Gesner; Mississippi, Jas. Hough; Louisiana, B. H. Brodnax; N. Jersey, F. D. Andrews; Florida, S. T. Walker.

Washington, Anthropological Society of—Vol. I of the Proceedings up to Dec. 31, 1880, contains archæological papers by Cushing, Mason, De Hass, Reynolds and McGuire.

WHITTLESEY, COL. CHARLES (Cleveland, O.)—Relics of aboriginal art and their ethnologic value. No. 52. W. Reserve and No. Ohio Hist. Soc., May, 1880. See also *Am. Antiquarian*, III, No. 1.

WIENER, CHARLES—Pérou et Bolivie. Paris, Hachette & Co., 1 vol., pp. 796, 1100 cuts, 27 charts and 18 plans, gr. 8vo. [A superb work.]

III. *Biological Anthropology.* — In the division of biological anthropology are included all labors relative to man as an animal. Whether or not intellection shall be included will be left an open question. There is no doubt, however, of the great value derived to anthropology from a comparison of the human being with other living forms, from the dawn of life to the night of death. Again, anthropology was at first studied almost solely by physicians, and the number of those who attach great importance to anthropometry and structural characters in determining race, etc., is very large. Our own country, alas, is not up to the mark in this particular, and the list of authorities can soon be read over.

Anthropological Society of Washington. Papers by Dr. Swan M. Burnett on color blindness as affected by race. Vol. I, 7.

BOTELER, W. C.—Peculiarities of American Indians from a physiological and pathological standpoint. *Maryland M. J.*, Baltimore, 1880–1, VII, 54–58.

HADRA, B. E.—Mensuration of the thorax below the diaphragm. *Boston M. and S. J.*, 1880, 247–249.

HAYMOND, W. S.—Human longevity. Tr. Indiana M. Soc., Indianapolis, 1880, 73–99.

SPITZKA, E. C.—Contributions to anatomical anthropology, chiefly the encephalon. *Science*, I, pp. 73, 125, 134, 176, 202, 235, 251, 303; *J. Nerv. and Ment. Dis.*, Ap. and July, 1880, p. 106; see also *ibid*, Oct., and *St. Louis Clin. Record*, Jan., Feb., April, May, June, Aug., Sept., 1880.

YARROW, H. C.—Medical facts relating to the Zuñi Indians of N. Mexico. *Rocky Mt. M. Rev.*, Colorado Springs, 1880, 192–194.

IV. *Comparative Psychology.*—Psychical anthropology has to do with ratiocination, emotion and volition from two points of view. In the first place it is a proper subject of investigation whether the difference in the manifestation of the qualities just mentioned is one of kind or one of degree in man and the lower animals. In the language of the physicist we would know whether the difference is quantitative or qualitative also. However this may be settled, there springs up a question of vital significance to us as Americans and to all civilized nations that have uncivilized tribes to deal with. It is this: Are there psycho-racial characteristics which should be regarded in treating with various peoples? Another query might arise whether there are intellectual boundaries, mental gradations, psychic lines of promotion along which spiritual growth must take place. Whatever may be the outcome of these problems, there is no lack of activity among investigators.

Bibliograph:

Animal instinct in relation to the mind of man. *Science*, I, 267, 280.

LINDSAY, W. LAUDER—The moral sense in the lower animals. *Pop. Sc. Month.*, Feb.

PORTER, PROFESSOR SAMUEL—Is thought possible without language? Case of a deaf-mute. Tr. Anthrop. Soc., Washington, I, 74.

PREGER, W.—Psychogenesis in the human infant. *Pop. Sc. Month.*, Sept.

V. *Ethnology.* — Men are found in groups called variously, tribes, nations, races, peoples, stocks, etc. No two ethnologists agree as to the proper distinguishing marks, or to the number of the groups; yet every traveler knows that such divisions of mankind exist. A rough definition of one of these units would be a collection of human beings occupying a given territory, who recognize in one another a common bond of kinship. Physical, mental, linguistic, social and religious peculiarities are usually coördinated with territory and kinship.

The following works have appeared during 1880:

ACOSTA, J. DE—The natural and moral history of the Indies. Reprinted from the English edition by Edward Grimshaw, 1604, and edited with notes and an introduction by Cl. R. Markham. London, Hackluyt Soc., 1880, I v., pp. 295, I chart, 8vo.

BRACKETT, ALBERT S.—The Shoshones or Snake Indians; their religion, superstitions and manners. Smithson. Rep., 1879, 328.

DUNBAR, J. B. (Deposit, N. Y.)—The Pawnee Indians. *Mag. Am. Hist.*, April, Nov., 1880. See also on the decrease of the Indians. *Ks. City Rev.*, Sept.

FLOWER, W. H.—The American Races. *Brit. M. J.*, London, 1880, I, 549, 577, 616.

HAVARD, V.—French and Indian half-breeds. Smithson Rep., 1879.

ICAZBALCETA, JOAQUIN GARCIA (Mexico)—Historia de los Mexicanos por sus pinturas. An. d. Mus. Nac. de Mexico, II, 85–106.

LEGGE, WM. (Toronto)—Canada and her Indian tribes. *Canadian Month.*, Aug., 1880, p. 137–149.

LEMLY, H. R.—Among the Arrapahoes. *Harper's Mag.*, March.

Narragansett tribe of Indians. Providence, E. L. Freeman & Co., 1880. Pamph. pp. 92, 8vo.

OBER, FREDERICK A.—Camps in the Caribees. Boston, Lee & Shepard, I vol., 12mo.

PUTNAM, F. W.—The Indians of California. Bull. Essex Inst., XII, Mar. 1, 1880.

REY, PHILIPPE MARIUS—Etude anthropologique sur les Botocudos. Paris, 1880.

RIALLE, GIRARD DE—Les peuples de l'Afrique et de l'Amerique. Bibliotheque Utile, Vol. IV. Paris, Balliere & Cie, 1880, pp. 184.

ROYCE, C. C.—An inquiry into the history and identity of the Shawnee Indians. Tr. Anthrop Soc., Washington, I, 94.

SHEA, JOHN GILMARY—A description of Louisiana. By Father Louis Hennepin, I.

VI. *Linguistic Anthropology.*—A linguist is not necessarily an anthropologist; indeed, a philologist, or one versed in the comparative study of language, may prosecute his researches in such a manner as to fall short of the meaning of the term. Linguistic anthropology is the study of language, first in its origin, as the medium of communicating thought, emotion and volition. In this sense animals have language. In the second place, it takes into consideration the evolution and the elaboration of language to keep pace with human progress. Thirdly, there are genera and species of language, that is to say, there are *summa genera*, or great divisions, which are separable into stocks, tongues and dialects. It is the design of the anthropologists to comprehend all the languages of the world in a vast scheme as the botanist groups his plants or the zoölogist his animal specimens. In order to accomplish this end it is necessary to become acquainted with the plan of structure of every language on earth. It is for this purpose, and not for their commercial value, that so much pains is

taken in preserving the language of savages. The Bureau of Ethnology of the Smithsonian Institution, under the management of Major J. W. Powell, is devoting most of its energies to this branch of the subject. Indeed it is one of the departments of anthropology of which our country has just reason to be proud. The following works appeared in 1880:

CHARENCY, H. DE—Archéologie Americaine. Déchiffrement des écritures calculiformes ou Mayas, le bas-relief de la croix de Palenque et le manuscrit Troano. Alencon, de Broise, 1880, pp. 52, figs., 8vo.

FAY, E. A.—The testimony of the Romance languges concerning the forms of the imperfect and pluperfect subjunctive in the Roman folk-speech. Tr. Anthrop. Soc. Wash., I, 72. Reprinted in the *Am. J. of Philology.*, I, p. 411.

GATSCHET, ALBERT SAMUEL (Bureau of Ethnology, S. I., Washington, also editor of the dept. of language in the *Am. Antiquarian*)—The numeral adjectives in the Klamath language, So. Oregon. *Am. Antiq.*, II, 210–217. The Timucua language. Proc. Am. Phil. Soc., Feb. 20, 1880. Indian color names. Tr. Anthrop. Soc. of Wash., I, 10.

MALLERY, GARRICK (Bureau of Ethnology, S. I., Washington, D. C.)—Introduction to the study of sign language among the No. Am. Indians as illustrating the gesture speech of mankind. Washington, Gov. Printing Office, 1880, pp. 72, 4to.

A collection of gesture signs and signals, &c., distributed to collaborators. Same printer, pp. 329, 4to.

MASON, OTIS T.—A comparison of a written language with one that is spoken only. Tr. Anthrop. Soc. W., I, 21.

MOLINA, PADRE FR. ALONZO DE—Vocabulario de la Lengua Mexicana. Platzman ed. Leipzig, Tuebner, 1880.

OROZCO Y BERRO, MANUEL (Mexico)—Codice Mendocino. Anales del Mus. Nac. d. Mex., II, 47–82, 127–130, 205–222.

PAUSOT, J.—Note sur la langue des Taensas. *Rev. Linguistique*, Ap.

POWELL, J. W. (Chief of the Bureau of Ethnology, Washington, D. C.)—On the evolution of language. Tr. Anthrop. Soc., W., I, 35.

Introduction to the study of Indian languages. Washington, Govt. Print. Off., XI, pp. 228, 8 ruled leaves, 4 charts, 4to.

VALENTINI, PHILIPP, J. J.—The Landa alphabet. Proc. Am. Antiq. Soc., Ap. 28. 1880.

VII. *Technology.*—In looking over the whole area of human activity, one is struck with the great variety of industries which have grown up around a few necessities—for food, clothing, shelter, emotional gratification, and the means of enforcing volition. This class of investigations we exclude from Mr. Spencer's notion of sociology, including under technology his operative phenomena; and retaining sociology for the manifestation of society in the family, the guild and the state. A third class of questions will then be grouped under religion or Sebastic anthro-

pology. Let it be borne in mind that this classification is for the convenience of investigators. The following works are noted:

BUTLER, PROFESSOR J. D.—Aboriginal use of copper in war and peace. *Am. Antiquarian*, III, No. 1.

DAHLBERG, R. N. and Charles L.—Composition of ancient pottery. Smithson Rep., 1879, 349.

GOODE, G. BROWN—The use of agricultural fertilizers by the Am. Indians. *Am. Naturalist*, July, 1880.

GORE, J. HOWARD—Tuckahoe, or Indian bread. Tr. Anthrop. Soc. W., I, 101.

HOY. P, R. (Racine, Wis.)—How were copper implements fabricated by the aborigines of this country. Wis. Histor. Collections, VIII.

KNIGHT, EDWARD H.—A study of savage weapons at the Centennial Exhibition, Philadelphia, 1876. Smithson. Rep., 1879, 213–297. [Profusely illustrated. Separately printed for distribution.]

MORGAN, LEWIS H.—A study of the houses of the American aborigines, with suggestions for the explorations of the ruins of New Mexico, Arizona, the valley of the San Juan, Yucatan and Central America. Rep. Archæol. Inst. of Am. 1879-1880.

SCHUMACHER, PAUL—The method of making pottery and baskets by the Indians of So. California. Rep. Peabody Mus., II, 521-525.

SOLLAS, W. J.—On some Eskimo bone implements from the east coast of Greenland. *J. Anthrop Inst.*, IX, 329–336.

VIII. *Sociology.*—Biography and history are records of human actions done by individuals or organized communities. Sociology is based on human actions also. The line of demarcation is here. Of any people their history would tell what they did in this or that emergency, but sociology inquires into what they were accustomed to do. The dividing line is like the sutures of the cranium, exceedingly crooked and involved, but with a little care it is not difficult to decide where history leaves off and sociology begins. The appearance of the Rev. Lorimer Fison's work on Australian marriage laws, with an introduction by Mr. Lewis H. Morgan, has been the occasion of brightening up old armor by Mr. McLennan and others who do not agree with our fellow-citizen.

BANDELIER, AD. F.—On the social organization and mode of government of the ancient Mexicans. Rep. Peabody Mus., II, 557–699.

DUNBAR, J. B.—The decrease of the North American Indians. *Kan. City Rev.*, Sept.

GORE, J. HOWARD.—The development of deliberative government among the No. Am. Indians. Tr. Anthrop. Soc. Washington, I, 58. By the same author, The old Roman Senate: a study of deliberative assemblies, *id.*, 9.

HOUGH, M. B. W.—Civilization. Tr. Anthrop. Soc. W., I, 100.

POWELL, J. W.—Wyandotte Government. A short study of tribal society. A. A. A. S., Boston. *Science*, I, No, 17; Cong. Record, Feb. 1, 1881; Tr. Anthrop. Soc. W., I, 76.

ROYCE, C. C.—The Indian title. The method and chronology of its extinction. Tr. Anthrop. Soc. W., I, 84.

YARROW, HENRY CRECY—Introduction to the study of mortuary customs among the No. Am. Indians. Washington, Gov. Print. Office.

IX. *Religion.*—Religion, in its widest sense, includes the belief in the existence of spiritual beings, together with all the paraphernalia and observances which have grown up around that belief. In this sense the anthropologist takes the term and seeks to trace its origin and history. The following works appeared in 1880:

ANDERSON, RASMUS B.—Teutonic mythology. *Am. Antiquarian*, II, No. 4. [Professor Anderson conducts the department of Pre-columbian Hist. in the *Antiquarian.*]

DORSEY, J. OWEN—The rabbit and the grasshopper: an Otœ myth. *Am. Antiquarian*, III, 1.

GATSCHET, A. S.—Superstitions. Tr. Anthrop. Soc. W., I, p. 103.
The four creations of mankind; a Tualati myth, *id.*, 60.

LUQUINS—The Avesta and the storm myth. *New Englander*, Sept.

MALLERY, GARRICK—Comparative mythology of the two Indies. Tr. Anthrop. Soc. W., I, 12.

POWELL, J. W.—Mythologic philosophy. Vice-president's address before the Am. Association at Saratoga, Vol., XXVIII.

RIGGS, STEPHEN R.—The Theogony of the Sioux. *Am. Antiquarian*, II, 4.

X. *Instrumentalities.*—Under this head we have no more to do than to enumerate the sources of information to which the student must go for his materials of study.

American Antiquarian, Rev. S. D. Peet, Clinton, Wisconsin, Ed.

American Association for the Advancement of Science, Vol. XXVIII, Saratoga Meeting.

American Naturalist, McCalla & Stavely, Philad. Papers by various authors. Notes by O. T. Mason.

Anthropological Society of Washington. J. W. Powell, Prest., C. C. Royce, Sec.

Archæological Institute of America, Boston. Edward H. Greenleaf, Sec.

BOEHMER, GEORGE H.—Index of papers on anthropology published by the Smithson. Inst. from 1847–1878. Sm. Rep., 1879 and separate.

Davenport Academy, Iowa. Proceedings. J. D. Putnam, Prest.

DAVIS, CHARLES H. S.—Index of articles on archæology, anthropology and ethnology. *Am. Antiquarian*, II, No 3, 239.

Index Medicus. A monthly classified record of the current medical literature of the world. Compiled under the supervision of Dr. John S. Billings and Dr. Robert Fletcher, Vol. II, 1880. N. Y., Leypoldt.

Index to Periodical Literature. Published by the American News Co., N. Y.

Index-Catalogue of the Library of the Surgeon-General's Office, United States Army. Authors and subjects. Vol. I. A. Berlinski with a list of abbreviations of titles of periodicals, indexed. Washington, Govt. Printing Office, 1880.

[Under the word anthropology, pages 437–444, will be found a grand collection of titles and journals. A list of abbreviations occupies pp. 1–126. Without exception this work is the most minute specimen of cataloguing in existence.]

MASON, O. T.—For Anthropological Summaries. Smithson. Rep., 1879. 428–475. *Am. Naturalist*, May, and Notes in each number from Jan.–December.

Peabody Museum, Cambridge, Mass. Twelfth and Thirteenth Annual Reports, Vol. II, Nos. 3 and 4.

Popular Science Monthly. N. York, D. Appleton & Co.

RHEES, WM. J.—Visitors' Guide to the Smithsonian Institution and the National Museum. Washington.

Saint Louis Academy of Natural Sciences, Nathaniel Holmes, Secretary.

Smithsonian Institution. Annual Report. Contributions to knowledge.

Besides these, there are innumerable sources of publication in our country of which anthropologists are willing to avail themselves, and in which they seem willing to hide their productions. All of these that have any value, however, find mention in the *Index Medicus*, or in the *Index to Periodical Literature*. Pamphlets and brochures should be sent to the editor of the Department of Anthropology in the AMERICAN NATURALIST, addressed to 1305 Q st., N. W., Washington, D. C.

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## THE MANUSCRIPT TROANO.[1]

BY PROFESSOR CYRUS THOMAS.

This manuscript was found about the year 1865 at Madrid, Spain, by the Abbe Brasseur de Bourbourg while on a visit to the Library of the Royal Historical Academy and named by him "Manuscript Troano," in honor of its possessor Don Juan de Tro y Ortolano.

So far as I am aware nothing more is known in reference to its history; we are not even informed by its last owner where or how he obtained it. In ordinary cases this would be sufficient to arouse our suspicions as to its genuineness, but in this case the work itself will dispel all such suspicions.

This work was reproduced in fac-simile by a chromo-lithographic process, by the *Commission Scientifique du Mexique* under the auspices of the French Government, Brasseur de Bourbourg being the editor.

The original is written on a strip of Maguey paper about four-

[1] Extracts from a paper now being prepared by Professor Thomas for the Bureau of Ethnology, Smithsonian Institution.

teen feet long and nine inches wide, the surface of which is covered with a white paint or varnish on which the characters and figures are painted in black, red, blue and brown. It is folded fan-like into thirty-five folds, presenting when the folds are pressed together the appearance of an ordinary octavo volume. The hieroglyphics and figures cover both sides of the paper comprising seventy pages, the writing and painting of the figures having been apparently executed, after the paper was folded, so that the folding does not interfere with the writing.

A slight examination of this manuscript is sufficient to convince any one at all familiar with Landa's characters that those used here are substantially the same, be the significations what they may. On almost every page are to be found columns of characters agreeing precisely with those given by him as reprerenting the Maya days. Are they used on account of the signification of the words they represent, as Brasseur supposed, or simply to designate days?

The determination of this point must be one important step toward ascertaining the object and contents of the work.

Another prominent feature of the manuscript is the great number of numerals or numeral characters—short straight lines and dots—found on every plate. These, together with the columns of day characters, constitute fully one half the written portion of the work; hence if we can ascertain the method in which, and the object for which, these were used, sufficient will have been learned to indicate, beyond doubt, the character of the work, and will render the task of deciphering the hieroglyphs much easier than to work at them blindly.

Assuming that the reader is familiar with what has already been written upon this subject, I will at once proceed with what I believe to be the correct explanation of the use of these two classes of characters in this manuscript, and which I believe is the key that will ultimately unlock its mysteries.

As I shall have occasion to refer very frequently to the Maya calendar, and cannot, without occupying too much space, give here a full explanation of it, I refer the reader to the following easily accessible works: "Bancroft's Native Races," Vol. II, and Dr. Valentini's article in the Proceedings American Antiquarian Society, giving here only the following brief summary:

TABLE I.

| Nos. | No. of Maya Days. |
|---|---|
| 1 | Kan |
| 2 | Chicchan |
| 3 | Cimi |
| 4 | Manik |
| 5 | Lamat |
| 6 | Muluc |
| 7 | Oc |
| 8 | Chuen |
| 9 | Eb |
| 10 | Ben |
| 11 | Ix |
| 12 | Men |
| 13 | Cib |
| 1 | Caban |
| 2 | Ezanab |
| 3 | Cauac |
| 4 | Ahau |
| 5 | Ymix |
| 6 | Ik |
| 7 | Akbal |

Their year consisted of eighteen months of twenty days each, and five intercalated or added days at the end. These added days—to make the full number, 365—were not counted in any of the months, as the month never counted more or less than twenty days. The names of these twenty days are given in the annexed table. Although they were sometimes numbered from 1 to 20, yet the usual method, especially in computations of time relating to religious feasts and ceremonies, was as shown in the table. Commencing with 1 they were numbered to 13, the following day instead of being 14 was numbered 1, the next 2, and so on to 13. As will be seen from the table, supposing it to represent the first month, the second month would begin with 8 Kan, and so on through the year as shown in the following table of the months and days:

TABLE II.

| Names of the Months. | Pop | Uo | Zip | Tzoz | Tzec | Xul | Yaxkin | Mol | Chen | Yax | Zac | Ceh | Mac | Kankin | Muan | Pax | Kayeh | Cumhu | Numbers of the Days of the Month. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Numbers of the Months. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | |
| Names of Days. | | | | | | | | | | | | | | | | | | | |
| Kan | 1 | 8 | 2 | 9 | 3 | 10 | 4 | 11 | 5 | 12 | 6 | 13 | 7 | 1 | 8 | 2 | 9 | 3 | 1 |
| Chicchan | 2 | 9 | 3 | 10 | 4 | 11 | 5 | 12 | 6 | 13 | 7 | 1 | 8 | 2 | 9 | 3 | 10 | 4 | 2 |
| Cimi | 3 | 10 | 4 | 11 | 5 | 12 | 6 | 13 | 7 | 1 | 8 | 2 | 9 | 3 | 10 | 4 | 11 | 5 | 3 |
| Manik | 4 | 11 | 5 | 12 | 6 | 13 | 7 | 1 | 8 | 2 | 9 | 3 | 10 | 4 | 11 | 5 | 12 | 6 | 4 |
| Lamat | 5 | 12 | 6 | 13 | 7 | 1 | 8 | 2 | 9 | 3 | 10 | 4 | 11 | 5 | 12 | 6 | 13 | 7 | 5 |
| Muluc | 6 | 13 | 7 | 1 | 8 | 2 | 9 | 3 | 10 | 4 | 11 | 5 | 12 | 6 | 13 | 7 | 1 | 8 | 6 |
| Oc | 7 | 1 | 8 | 2 | 9 | 3 | 10 | 4 | 11 | 5 | 12 | 6 | 13 | 7 | 1 | 8 | 2 | 9 | 7 |
| Chuen | 8 | 2 | 9 | 3 | 10 | 4 | 11 | 5 | 12 | 6 | 13 | 7 | 1 | 8 | 2 | 9 | 3 | 10 | 8 |
| Eb | 9 | 3 | 10 | 4 | 11 | 5 | 12 | 6 | 13 | 7 | 1 | 8 | 2 | 9 | 3 | 10 | 4 | 11 | 9 |
| Ben | 10 | 4 | 11 | 5 | 12 | 6 | 13 | 7 | 1 | 8 | 2 | 9 | 3 | 10 | 4 | 11 | 5 | 12 | 10 |
| Ix | 11 | 5 | 12 | 6 | 13 | 7 | 1 | 8 | 2 | 9 | 3 | 10 | 4 | 11 | 5 | 12 | 6 | 13 | 11 |
| Men | 12 | 6 | 13 | 7 | 1 | 8 | 2 | 9 | 3 | 10 | 4 | 11 | 5 | 12 | 6 | 13 | 7 | 1 | 12 |
| Cib | 13 | 7 | 1 | 8 | 2 | 9 | 3 | 10 | 4 | 11 | 5 | 12 | 6 | 13 | 7 | 1 | 8 | 2 | 13 |
| Caban | 1 | 8 | 2 | 9 | 3 | 10 | 4 | 11 | 5 | 12 | 6 | 13 | 7 | 1 | 8 | 2 | 9 | 3 | 14 |
| Ezanab | 2 | 9 | 3 | 10 | 4 | 11 | 5 | 12 | 6 | 13 | 7 | 1 | 8 | 2 | 9 | 3 | 10 | 4 | 15 |
| Cauac | 3 | 10 | 4 | 11 | 5 | 12 | 6 | 13 | 7 | 1 | 8 | 2 | 9 | 3 | 10 | 4 | 11 | 5 | 16 |
| Ahau | 4 | 11 | 5 | 12 | 6 | 13 | 7 | 1 | 8 | 2 | 9 | 3 | 10 | 4 | 11 | 5 | 12 | 6 | 17 |
| Ymix | 5 | 12 | 6 | 13 | 7 | 1 | 8 | 2 | 9 | 3 | 10 | 4 | 11 | 5 | 12 | 6 | 13 | 7 | 18 |
| Ik | 6 | 13 | 7 | 1 | 8 | 2 | 9 | 3 | 10 | 4 | 11 | 5 | 12 | 6 | 13 | 7 | 1 | 8 | 19 |
| Akbal | 7 | 1 | 8 | 2 | 9 | 3 | 10 | 4 | 11 | 5 | 12 | 6 | 13 | 7 | 1 | 8 | 2 | 9 | 20 |

| Intercalated Days. | |
|---|---|
| Kan | 10 |
| Chicchan | 11 |
| Cimi | 12 |
| Manik | 13 |
| Lamat | 1 |

If the first day of the year was Kan, as in this table, then each month would commence with Kan and end with Akbal, though numbered differently. If the last day of the 18th month was 9 Akbal, as shown in this table, the five added days would be 10 Kan, 11 Chicchan, 12 Cimi, 13 Manik and 1 Lamat; the first day of the next year would be 2 Muluc.

When the year began with 2 Muluc, the last day of the 18th month would be 10 Lamat and the five added days would be 11 Muluc, 12 Oc, 13 Chuen, 1 Eb and 2 Ben. The next year would then begin with 3 Ix. Following out this process we shall find the years commencing as follows: 1 Kan, 2 Muluc, 3 Ix, 4 Cauac, 5 Kan, 6 Muluc, 7 Ix, 8 Cauac, 9 Kan, 10 Muluc, 11 Ix, 12 Cauac, 13 Kan, 1 Muluc, 2 Ix and so on, the first day being in all cases one of these four. As 13 is a prime number it will require a cycle of 52 years—13 × 4—before we again reach 1 Kan. I give here a table of one of these cycles, showing the order of the years for this length of time. The names by which the years of the different columns are designated are given at the head of the columns.

TABLE III.

| Kan. | Muluc. | Ix. | Cauac. |
|---|---|---|---|
| 1 | 2 | 3 | 4 |
| 5 | 6 | 7 | 8 |
| 9 | 10 | 11 | 12 |
| 13 | 1 | 2 | 3 |
| 4 | 5 | 6 | 7 |
| 8 | 9 | 10 | 11 |
| 12 | 13 | 1 | 2 |
| 3 | 4 | 5 | 6 |
| 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 1 |
| 2 | 3 | 4 | 5 |
| 6 | 7 | 8 | 9 |
| 10 | 11 | 12 | 13 |

Although their system was somewhat complicated by this singular method of numbering the days and years, still it is not difficult to understand it so far. But in order to further complicate this calendar, which was undoubtedly devised by the priests as Landa truly says, "to deceive this simple people," another period called the Katun or Ahau was introduced. This period, according to most authorities, consisted of twenty years, but according to Perez of twenty-four. Instead of being numbered in regular order, one, two, three, &c., these periods were also numbered by the thirteen series, but in the following singular order: 13, 11, 9, 7, 5, 3, 1, 12, 10, 8, 6, 4, 2, the 13th Katun preceding the 11th, and so on.

The chief difficulty experienced in attempting to bring this period into harmony with the system so far as given, is, 1st. The uncertainty as to whether it consisted of 20 or 24 years; 2d. To place these periods in their proper positions in the great cycle, that is, to determine what year in any cycle was the *first* year of a Katun. If this can be done, then it is not difficult to compare

the years of the Maya calendar with those dated from the Christian era, if any one can be determined.

The reader will observe that we have so far proceeded upon the assumption that the first year of the cycle was 1 Kan, or in other words, that the Kan column always occupied the extreme left. That the four days, Kan, Muluc, Ix, Cauac—or "year bearers," as they were called by the Mayas—must follow in the order given, is manifest, but that Kan must come first does not follow from anything apparent in the system itself; either day may be the first, without any change in the system, but not without a difference in the result. There are some reasons apparent in the manuscript itself for believing that the author considered Cauac the first, or ruling day, and hence Kan the second, Muluc the third and Ix the fourth. One of these reasons will be given hereafter.

The importance of knowing which one of these days came first will be apparent from the following illustration: A certain event, for example, is dated a particular day in the year, 1 Ix. By reference to the tables we give here—one commencing with Kan and the other with Cauac—we see that if the former be the correct one, the year 1 Ix would be the 27th year of the cycle (it is marked with a star); if the latter, it would be the 40th, or 13 years later.

TABLE IV.

| Kan. | Muluc. | Ix. | Cauac. |
|---|---|---|---|
| 1 | 2 | 3 | 4 |
| 5 | 6 | 7 | 8 |
| 9 | 10 | 11 | 12 |
| 13 | 1 | 2 | 3 |
| 4 | 5 | 6 | 7 |
| 8 | 9 | 10 | 11 |
| 12 | 13 | 1* | 2 |
| 3 | 4 | 5 | 6 |
| 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 1 |
| 2 | 3 | 4 | 5 |
| 6 | 7 | 8 | 9 |
| 10 | 11 | 12 | 13 |

TABLE V.

| Cauac. | Kan. | Muluc. | Ix. |
|---|---|---|---|
| 1 | 2 | 3 | 4 |
| 5 | 6 | 7 | 8 |
| 9 | 10 | 11 | 12 |
| 13 | 1 | 2 | 3 |
| 4 | 5 | 6 | 7 |
| 8 | 9 | 10 | 11 |
| 12 | 13 | 1 | 2 |
| 3 | 4 | 5 | 6 |
| 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 1* |
| 2 | 3 | 4 | 5 |
| 6 | 7 | 8 | 9 |
| 10 | 11 | 12 | 13 |

As we shall have to refer very frequently to the calendar, it becomes necessary that we construct one. Since the system admits of fifty-two changes in the day on which the year begins, it would require fifty-two calendars to include the years of one cycle, just as fourteen are required to suit all the years of our system—seven for the ordinary and seven for the leap years.

As it would require much time and space to write these out in

full, I have adopted the expedient shown in the following table of abbreviating the work:

TABLE VI.

A CONDENSED MAYA CALENDAR.

| Cauac Column. | Kan Column. | Muluc Column. | Ix Column. | 1 14 | 2 15 | 3 16 | 4 17 | 5 18 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Numbers of the Months. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | Days of Month. |
| Cauac | Kan | Muluc | Ix | 1 | 8 | 2 | 9 | 3 | 10 | 4 | 11 | 5 | 12 | 6 | 13 | 7 | 1 |
| Ahau | Chicchan | Oc | Men | 2 | 9 | 3 | 10 | 4 | 11 | 5 | 12 | 6 | 13 | 7 | 1 | 8 | 2 |
| Ymix | Cimi | Chuen | Cib | 3 | 10 | 4 | 11 | 5 | 12 | 6 | 13 | 7 | 1 | 8 | 2 | 9 | 3 |
| Ik | Manik | Eb | Caban | 4 | 11 | 5 | 12 | 6 | 13 | 7 | 1 | 8 | 2 | 9 | 3 | 10 | 4 |
| Akbal | Lamat | Ben | Ezanab | 5 | 12 | 6 | 13 | 7 | 1 | 8 | 2 | 9 | 3 | 10 | 4 | 11 | 5 |
| Kan | Muluc | Ix | Cauac | 6 | 13 | 7 | 1 | 8 | 2 | 9 | 3 | 10 | 4 | 11 | 5 | 12 | 6 |
| Chicchan | Oc | Men | Ahau | 7 | 1 | 8 | 2 | 9 | 3 | 10 | 4 | 11 | 5 | 12 | 6 | 13 | 7 |
| Cimi | Chuen | Cib | Ymix | 8 | 2 | 9 | 3 | 10 | 4 | 11 | 5 | 12 | 6 | 13 | 7 | 1 | 8 |
| Manik | Eb | Caban | Ik | 9 | 3 | 10 | 4 | 11 | 5 | 12 | 6 | 13 | 7 | 1 | 8 | 2 | 9 |
| Lamat | Ben | Ezanab | Akbal | 10 | 4 | 11 | 5 | 12 | 6 | 13 | 7 | 1 | 8 | 2 | 9 | 3 | 10 |
| Muluc | Ix | Cauac | Kan | 11 | 5 | 12 | 6 | 13 | 7 | 1 | 8 | 2 | 9 | 3 | 10 | 4 | 11 |
| Oc | Man | Ahau | Chicchan | 12 | 6 | 13 | 7 | 1 | 8 | 2 | 9 | 3 | 10 | 4 | 11 | 5 | 12 |
| Chuen | Cib | Ymix | Cimi | 13 | 7 | 1 | 8 | 2 | 9 | 3 | 10 | 4 | 11 | 5 | 12 | 6 | 13 |
| Eb | Caban | Ik | Manik | 1 | 8 | 2 | 9 | 3 | 10 | 4 | 11 | 5 | 12 | 6 | 13 | 7 | 14 |
| Ben | Ezanab | Akbal | Lamat | 2 | 9 | 3 | 10 | 4 | 11 | 5 | 12 | 6 | 13 | 7 | 1 | 8 | 15 |
| Ix | Cauac | Kan | Muluc | 3 | 10 | 4 | 11 | 5 | 12 | 6 | 13 | 7 | 1 | 8 | 2 | 9 | 16 |
| Men | Ahau | Chicchan | Oc | 4 | 11 | 5 | 12 | 6 | 13 | 7 | 1 | 8 | 2 | 9 | 3 | 10 | 17 |
| Cib | Ymix | Cimi | Chuen | 5 | 12 | 6 | 13 | 7 | 1 | 8 | 2 | 9 | 3 | 10 | 4 | 11 | 18 |
| Caban | Ik | Manik | Eb | 6 | 13 | 7 | 1 | 8 | 2 | 9 | 3 | 10 | 4 | 11 | 5 | 12 | 19 |
| Ezanab | Akbal | Lamat | Ben | 7 | 1 | 8 | 2 | 9 | 3 | 10 | 4 | 11 | 5 | 12 | 6 | 13 | 20 |

As each of the four days (the year bearers) can have but thirteen different numbers, it is unnecessary for us to have more than thirteen columns of numbers; when we reach the thirteenth column, or month, we have passed through all possible changes of numbers, and the fourteenth month begins with one as did the first. Instead, therefore, of having eighteen columns in our table, we need to extend it only so as to include thirteen, as we can use the first, second, third, fourth and fifth respectively for the fourteenth, fifteenth, sixteenth, seventeenth and eighteenth months, as indicated by the numbers of the months which we have placed above the table.

The reader must bear in mind the fact that although we have numbered the months as commencing with the left hand column, which has 1 for its upper figure; yet this holds good only when the year is 1 Cauac, 1 Kan, 1 Muluc or 1 Ix, and for none of the other years. The first month of the year may be any one of the thirteen columns, thus, 8 Cauac, 8 Kan, 8 Muluc and 8 Ix have the second column—which has 8 as its top figure—as their first month, then the one with 2 at top will be the second month, and so on to the thirteenth (7 at top) which will be the 12th month. Then we go back to the first column (1 at top) for the 13 month, and so on to the one with 10 at top for the 18th month. As the months always retain the same order and numbers, by knowing the column with which the year begins, we can, by counting in this way, find any month for any possible year. We must here warn the reader against confounding the *days of month* with the *days of the week*, the latter being the ones by which the days are usually designated; we must also warn him against confounding the *numbers of the months* with the *top numbers of the columns.* I will now show how this table is to be used by giving one or two examples:

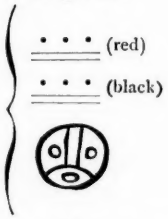
Given the day 8 Ahau and the year 11 Kan to find the month and *day of the month.* As the year is 11 *Kan*, we must look to the Kan column. By running our eyes down this column we find that Ahau is the 17th day; then by looking along the 17th transverse line we find the figure 8 to be in the column which has 5 at the top, which we find is the second (always counting both) from the column with 11 at top; hence 8 Ahau of the year 11 Kan is the 17th day of the 2d month.

In the same way we find that 8 Ahau of the year 11 Muluc is

the 12th day of the 12th month, but in this case we have to count the columns from the one having 11 at top (always inclusive) to the right through to the thirteenth (the one with 7 at top), and then go back to the first and count up to the one in which we find 8 in the twelfth transverse line.

In the Perez manuscript, translated by Stephens and published in his "Yucatan," Vol. II, we find it stated that one Ajpula died "in the year 4 Kan, the 18th day of the month Zip on 9 Ymix." The year 4 Kan begins with the column of our table which has 4 as its top figure; the third month (Zip) will then be the one with 5 at the top; running down this to the eighteenth transverse line, we find the figure 9, we also find that the 18th day of the Kan column is Ymix, agreeing exactly with the date given.

In the Manuscript Troano we find another method of giving dates, which is very common throughout the work, thus:




This, according to my interpretation, signifies 13 Ahau of the 13th month. As neither the year nor the day of the month is given, it is evident that we may find four dates satisfying the demand. Turning to our table we commence with the Ahau in the Cauac column, which we find is the second day of the month. The 13 in the second transverse we find in the column having 11 at the top; by counting *back* thirteen months (always including the one counted from and to) we find that the first month of the year is the one with 6 at the top, hence the year is 6 Cauac. The backward counting is exactly the reverse of the forward counting—count toward the left until the first column is reached, then return to the thirteenth and so on until the number of the month required is reached.

Proceeding in the same way with the Ahau in the Kan, Muluc and Ix columns, we find the years to be 4 Kan, 9 Muluc and 1 Ix.

We are now prepared to discuss the question as to whether the numerals and day characters are used in the manuscript simply as dates or not.

By counting, I find there are about 235 recognizable columns

of day characters in the work, eight-ninths of which contain five characters each. Why this number? If, as I suppose, and as above illustrated, each has four dates (four different years) this gives to each of these columns twenty years ($4 \times 5 = 20$), or one Katun, for even according to the theory of Perez, four years of his period were not generally counted.

But before testing this suggestion, I wish to call attention to a certain regularity in the order of the days in these columns. The left hand column of the middle division of Plate X is composed of characters representing the following days (always reading from the top downwards) in the order here given: Oc, Cib, Ik, Lamat, Ix. If we turn to the list of days and count from one of these names to the other, we shall find in each case an interval of six days. The other column, same plate and division, contains the characters for Ahau, Cimi, Eb, Ezanab and Kan, with an interval of six days between each two. The column in the middle division of Plate VI shows an interval of five days between each two; the columns on Plate XVII, of twelve days; a column on Plate XXXI, of sixteen days; but the usual interval is either six or twelve days.

Although the interval is usually the same throughout a column, there are occasional departures from this rule, for example, in the left hand column of the upper division of Plate XIII, they are 6, 6, 4 and 2 days.

This fact, which is a marked characteristic of the work, is sufficient to show, beyond a reasonable doubt, that the days are here used simply as dates, and not for the signification of the words, as Brasseur supposed.

I understand that Charency has noticed a regularity in the order of the days, but as I have had no opportunity of examining his work, I am unable to state whether it is the fact here mentioned or not.

By examining Plates XX–XXIII, we see such a strong resemblance between them that we are forced to believe they relate to one and the same subject; the left hand column of each, which extends the whole length of the plate, is the repetition of a single day character with red numerals over each character. In Plate XXIII the character repeated is Cauac, one of the year bearers; the numerals over them are as follows, and in the following order (reading from the top downwards): 10, 1, 5, 9, 13, 4, 8, 12, (?), 7, (?), 2, 6—two of them being obliterated.

Turning to Plate XXII we find the character for Kan repeated in the same way with the numerals over them as follows: 11, 2, 6, 10, 1, 5, 9, (?), 4, 8, 12, 3, 7, 11.

On Plate XXI the character for Muluc is similarly repeated, and the numerals are 12, 3, 6, 10, 1, 5, 9, 13, 4, 8, 2, 7, 3.

On Plate XX Ix is similarly repeated, and here the numerals are 13, (?), 8, 12, 3, 7, 11, 2, 6, 10, 1, 5, 9.

If we construct a table of years for two cycles, and compare these numbers with those in the table, we shall find the two precisely the same and in the same order, except the Muluc column which presents a partial variation which I will endeavor presently to explain. We give both Cauac and Kan tables.

TABLE VII.

| Cauac. | Kan. | Muluc. | Ix. |
|---|---|---|---|
| 1 | 2 | 3 | 4 |
| 5 | 6 | 7 | 8 |
| 9 | 10 | 11 | 12 |
| 13 | 1 | 2 | 3 |
| 4 | 5 | 6 | 7 |
| 8 | 9 | 10 | 11 |
| 12 | 13 | 1 | 2 |
| 3 | 4 | 5 | 6 |
| 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 1 |
| 2 | 3 | 4 | 5 |
| 6 | 7 | 8 | 9 |
| 10 | 11 | 12 | 13 |
| 1 | 2 | 3 | 4 |
| 5 | 6 | 7 | 8 |
| 9 | 10 | 11 | 12 |
| 13 | 1 | 2 | 3 |
| 4 | 5 | 6 | 7 |
| 8 | 9 | 10 | 11 |
| 12 | 13 | 1 | 2 |
| 3 | 4 | 5 | 6 |
| 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 1 |
| 2 | 3 | 4 | 5 |
| 6 | 7 | 8 | 9 |
| 10 | 11 | 12 | 13 |

TABLE VIII.

| Kan. | Muluc. | Ix. | Cauac. |
|---|---|---|---|
| 1 | 2 | 3 | 4 |
| 5 | 6 | 7 | 8 |
| 9 | 10 | 11 | 12 |
| 13 | 1 | 2 | 3 |
| 4 | 5 | 6 | 7 |
| 8 | 9 | 10 | 11 |
| 12 | 13 | 1 | 2 |
| 3 | 4 | 5 | 6 |
| 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 1 |
| 2 | 3 | 4 | 5 |
| 6 | 7 | 8 | 9 |
| 10 | 11 | 12 | 13 |
| 1 | 2 | 3 | 4 |
| 5 | 6 | 7 | 8 |
| 9 | 10 | 11 | 12 |
| 13 | 1 | 2 | 3 |
| 4 | 5 | 6 | 7 |
| 8 | 9 | 10 | 11 |
| 12 | 13 | 1 | 2 |
| 3 | 4 | 5 | 6 |
| 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 1 |
| 2 | 3 | 4 | 5 |
| 6 | 7 | 8 | 9 |
| 10 | 11 | 12 | 13 |

If we run our eyes down the Cauac column of either table until we reach 10, we shall find the numbers from thence downwards as follows: 10, 1, 5, 9, 13, 4, 8, 12, 3, 7, 11, 2, 6, precisely as in Plate XXIII. The same thing is true in reference to the Kan and Ix columns.

The numbers on Plate XXI (Muluc) after the first two—12 and 3—skip to 6 and continue regularly from thence to 8. If we start with 12, we find the next to be 3 as given, the next is 6 instead of 7, as it should be; we notice that in the adjoining Kan column the next figure is 6, and the numbers thence to 8 as given. May we not suppose that the author of the manuscript had a similar table (with numeral characters) before him, and that in copying his eye fell on the wrong column? That such tables were used by them is rendered probable by the following quotation which Perez makes from an ancient manuscript in his possession:

"There was another number which they called *Ua Katun* and which served them as a key to find the Katunes; according to the order of its march it falls on the *Uayeb haab*, and revolves to the end of certain years, Katunes 13, 9, 5, 1, 10, 6, 2, 11, 7, 3, 12, 8, 4." By commencing at the bottom of either column of our table of years, and running up, we will find precisely these numbers, and in the order here given. It is scarcely possible these could have been obtained except by a table of years similar to those we have given. Be this as it may, the fact that these numerals and characters, as here interpreted, include a continuous period, is too plain to be ignored. The agreement in so many numbers and the order in which they come cannot be accidental.

From this we are justified in concluding, 1st. That these day characters are used simply to represent days; 2d. That the red numerals are used to denote the days or years of the Maya "week" (as their period of 13 days and years has been termed, though they applied no name to it), which is corroborated by the fact that with the exception of two on the title page, none in the manuscript denote a greater number than 13 (there is one other apparent exception, but the additional dot is a blotch or evident mistake); 3d. That the day columns are to be read from the top downwards; 4th. That Landa's characters for the Maya days are correct; and 5th. That the work is some kind of a calendar, probably containing directions to be followed by the priests and people in reference to their religious duties. Now let us apply our theory to the day columns and numerals found in some of the other plates.

We select as our first example the column in the lower division of Plate XXVI, as here both the red and black numerals are 13 throughout. The day characters are those for Ahau, Eb, Kan, Cib and Lamat, in the order here given. According to the interpretation suggested, the red numerals refer to the days of the week and the black to the days of the month. Proceeding upon this assumption, we will now try to find out, by using these numbers, in what years 13 Ahau, 13 Eb, 13 Kan, 13 Cib and 13 Lamat are to be found in the 13th month. The result is as follows:

| | *13 Ahau.* | *13 Eb.* | *13 Kan.* | *13 Cib.* | *13 Lamat.* |
|---|---|---|---|---|---|
| Years.... | 6 Cauac | 7 Cauac | 2 Cauac | 3 Cauac | 11 Cauac |
| " .... | 4 Kan | 12 Kan | 7 Kan | 8 Kan | 3 Kan |
| " .... | 9 Muluc | 4 Muluc | 5 Muluc | 13 Muluc | 1 Muluc |
| " .... | 1 Ix | 2 Ix | 10 Ix | 5 Ix | 6 Ix |

TABLE IX.

| Cauac. | Kan. | Muluc. | Ix. |
|---|---|---|---|
| 10 | 11 | 12 | 13 |
| 1 | 2 | 3 | 4 |
| 5 | 6 | 7 | 8 |
| 9 | 10 | 11 | 12 |
| 13 | 1 | 2 | 3 |
| 4 | 5 | 6 | 7 |
| 8 | 9 | 10 | 11 |
| 12 | 13 | 1 | 2 |
| 3 | 4 | 5 | 6 |
| 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 1 |
| 2 | 3 | 4 | 5 |
| 6 | 7 | 8 | 9 |
| 10 | 11 | 12 | 13 |
| 1 | 2 | 3 | 4 |
| 5 | 6 | 7 | 8 |
| 9 | 10 | 11 | 12 |
| 13 | 1 | 2 | 3 |
| 4 | 5 | 6 | 7 |
| 8 | 9 | 10 | 11 |

In order to bring clearly before the eye the places in the cycle where these years fall, we give here the Cauac table governing the period embraced in the four plates heretofore alluded to. Marking the numbers, we find a continuous period of twenty years, possibly one Katun, though not in the precise order we would expect it, that is, it does not include five complete transverse lines. If we use the Kan table, we obtain the same result, except that then we shall have three years in the uppermost line and but one in the lowest. The years of this period are surrounded by a continuous dark line.

As Plate XXVII appears to be a continuation of the same subject as that presented on Plate XXVI, we select the day column of the upper division. The days are 11 Ahau, 11 Eb, 11 Kan, 11 Cib and 11 Lamat—the months all the 13th. This gives us the following years:

| | *11 Ahau.* | *11 Eb.* | *11 Kan.* | *11 Cib.* | *11 Lamat.* |
|---|---|---|---|---|---|
| Years.... | 4 Cauac | 5 Cauac | 13 Cauac | 1 Cauac | 9 Cauac |
| " .... | 2 Kan | 10 Kan | 5 Kan | 6 Kan | 1 Kan |
| " .... | 7 Muluc | 2 Muluc | 3 Muluc | 11 Muluc | 12 Muluc |
| " .... | 12 Ix | 13 Ix | 8 Ix | 3 Ix | 4 Ix |

The numbers which are surrounded in the table by a waved line, also form, as we see, a continuous period of twenty years. We likewise observe that between the periods there is an interval of four years.

Plates VII, VIII, IX and X, of the second part of the manuscript furnish perhaps the strongest proof of the correctness of my interpretation of the red numerals. The middle division of these plates evidently refers to one subject. Here we find thirteen short columns, of three day characters each, inserted in the text, each character with red numerals over it, and each column with black numerals at the bottom denoting 17, as the month. We give here the names of the days with the number of each as shown by the red numerals; the order in which the columns occur is

also preserved although we have strong doubts as to the correctness of Brasseur's paging.

| | | | | | | |
|---|---|---|---|---|---|---|
| 6 Cib | 13 Cib | 4 Cib | 11 Cib | 5 Cib | 12 Cib | 2 Cib |
| 7 Caban | 1 Caban | 5 Caban | 12 Caban | 6 Caban | 13 Caban | 3 Caban |
| 8 Ezanab | 2 Ezanab | 6 Ezanab | 13 Ezanab | 7 Ezanab | 1 Ezanab | 4 Ezanab |
| 9 Cib | 3 Cib | 10 Cib | 7 Cib | 1 Cib | 8 Cib | |
| 10 Caban | 4 Caban | 11 Caban | 8 Caban | 2 Caban | 9 Caban | |
| 11 Ezanab | 5 Ezanab | 12 Ezanab | 9 Ezanab | 3 Ezanab | 10 Ezanab | |

We see by examining the list of days in the Table No. 11, that these three days follow each other in the order here given, thus: if the first is 6 Cib, the next is 7 Caban and the next 8 Ezanab. It follows, therefore, that the three days of any one of these groups must fall in the same month[1] and year, hence we have to search for but four years for each column—but $4 \times 13 = 52$ years, an entire cycle. As the three numbers in a group will sufficiently designate the group, we will omit the names.

| | *Years.* | *Years.* | *Years.* | *Years.* |
|---|---|---|---|---|
| 6, 7, 8..... | 7 Cauac | 12 Kan | 4 Muluc | 9 Ix |
| 13, 1, 2..... | 1 " | 6 " | 11 " | 3 " |
| 4, 5, 6..... | 5 " | 10 " | 2 " | 7 " |
| 11, 12, 13..... | 12 " | 4 " | 9 " | 1 " |
| 5, 6, 7..... | 6 " | 11 " | 3 " | 8 " |
| 12, 13, 1..... | 13 " | 5 " | 10 " | 2 " |
| 2, 3, 4..... | 3 " | 8 " | 13 " | 5 " |
| 9, 10, 11..... | 10 " | 2 " | 7 " | 12 " |
| 3, 4, 5..... | 4 " | 9 " | 1 " | 6 " |
| 10, 11, 12..... | 11 " | 3 " | 8 " | 13 " |
| 7, 8, 9..... | 8 " | 13 " | 5 " | 10 " |
| 1, 2, 3..... | 2 " | 7 " | 12 " | 4 " |
| 8, 9, 10..... | 9 " | 1 " | 6 " | 11 " |

TABLE X.

| Canac. | Kan. | Muluc. | Ix. |
|---|---|---|---|
| 10 | 11 | 12 | 13 |
| 1* | 2* | 3* | 4* |
| 5* | 6* | 7* | 8* |
| 9* | 10* | 11* | 12* |
| 13* | 1* | 2* | 3* |
| 4* | 5* | 6* | 7* |
| 8* | 9* | 10* | 11* |
| 12* | 13* | 1* | 2* |
| 3* | 4* | 5* | 6* |
| 7* | 8* | 9* | 10* |
| 11* | 12* | 13* | 1* |
| 2* | 3* | 4* | 5* |
| 6* | 7* | 8* | 9* |
| 10* | 11* | 12* | 13* |
| 1 | 2 | 3 | 4 |

If we mark in the table the numbers corresponding with these years, we find that they make one complete cycle, neither more nor less. It is true we should find the same result, no matter where we begin in the cycle, but the point insisted on is, that they form a continuous term corresponding with one of the Maya periods.

We give one more example. In the second division of Plates xxx and xxxi commencing on the left half of the former and continuing through the latter, we find a series of similar figures, except the

[1] It is not necessary as a matter of course, that three successive days always fall in the same month, but in this case they do. In the Dresden codex plates 51–58, we find similar three day columns, some of which do not conform to this rule.

one on the right of the first plate, which is the god Tlaloc, or Maya equivalent. Over each figure are red numerals differing in number, and in front black numerals all denoting 11. The red numerals are (?) 9, 7, 5, 3. The first is obliterated, but judging from the space, is 1, but by the succession, is 11; however, as the result will be the same except as to the position of the period in the table, it does not make any material difference for present purposes, which we select. For reasons not necessary to be discussed here, notwithstanding the strong evidence afforded by the succession of numbers, we are inclined to believe the missing number was 1, and that the order was 9, 1, 3, 5, 7. The days found at the left of the compartment on Plate XXXI, are Kan, Cib, Lamat, Ahau, Eb; as each numeral applies to each day, the number of years indicated will be $5 \times 5 \times 4 = 100$, and will be as follows, the month being the 11th in each case:

| | *9 Kan.* | *9 Cib.* | *9 Lamat.* | *9 Ahau.* | *9 Eb.* |
|---|---|---|---|---|---|
| Years.... | 12 Cauac | 13 Cauac | 8 Cauac | 3 Cauac | 4 Cauac |
| " .... | 4 Kan | 5 Kan | 13 Kan | 1 Kan | 9 Kan |
| " .... | 2 Muluc | 10 Muluc | 11 Muluc | 6 Muluc | 1 Muluc |
| " .... | 7 Ix | 2 Ix | 3 Ix | 11 Ix | 12 Ix |
| | *7 Kan.* | *7 Cib.* | *7 Lamat.* | *7 Ahau.* | *7 Eb.* |
| Years.... | 10 Cauac | 11 Cauac | 6 Cauac | 1 Cauac | 2 Cauac |
| " .... | 2 Kan | 3 Kan | 11 Kan | 12 Kan | 7 Kan |
| " .... | 13 Muluc | 8 Muluc | 9 Muluc | 4 Muluc | 12 Muluc |
| " .... | 5 Ix | 13 Ix | 1 Ix | 9 Ix | 10 Ix |
| | *5 Kan.* | *5 Cib.* | *5 Lamat.* | *5 Ahau.* | *5 Eb.* |
| Years.... | 8 Cauac | 9 Cauac | 4 Cauac | 12 Cauac | 13 Cauac |
| " .... | 13 Kan | 1 Kan | 9 Kan | 10 Kan | 5 Kan |
| " .... | 11 Muluc | 6 Muluc | 7 Muluc | 2 Muluc | 10 Muluc |
| " .... | 3 Ix | 11 Ix | 12 Ix | 7 Ix | 8 Ix |
| | *3 Kan.* | *3 Cib.* | *3 Lamat.* | *3 Ahau.* | *3 Eb.* |
| Years.... | 6 Cauac | 7 Cauac | 2 Cauac | 10 Cauac | 11 Cauac |
| " .... | 11 Kan | 12 Kan | 7 Kan | 8 Kan | 3 Kan |
| " .... | 9 Muluc | 4 Muluc | 5 Muluc | 13 Muluc | 8 Muluc |
| " .... | 1 Ix | 9 Ix | 10 Ix | 5 Ix | 6 Ix |
| | *1 Kan.* | *1 Cib.* | *1 Lamat.* | *1 Ahau.* | *1 Eb.* |
| Years.... | 4 Cauac | 5 Cauac | 13 Cauac | 8 Cauac | 9 Cauac |
| " .... | 9 Kan | 10 Kan | 5 Kan | 6 Kan | 1 Kan |
| " .... | 7 Muluc | 2 Muluc | 3 Muluc | 11 Muluc | 6 Muluc |
| " .... | 12 Ix | 7 Ix | 8 Ix | 3 Ix | 4 Ix |

We give here a table running through four cycles, on which we mark the five periods indicated by the preceding list. Each,

as a matter of course, embraces twenty years, but we observe between each period four uncounted years. We must not presume from this that these years are never counted, as this is contradicted not only by the preceding example but by others which might be presented; still it does indicate that the view maintained by Perez was correct. Assuming that a Katun consisted of twenty-four years, we can see from this table why they were numbered in the peculiar manner heretofore mentioned. We see that the years with which the five, here marked, begin, are 11, 9, 7, 5, 3, in other words this order necessarily follows if the Katun or Ahau (we prefer the name Katun) consists of 24 years. If the upper and lower dark lines are extended across so as to include the whole 24 years, the periods will then commence with the years 9, 7, 5, 3, 1, and will, as I believe, give us the correct numbers of these Ahaues.

TABLE XI.

| Cauac. | Kan. | Muluc. | Ix. |
|---|---|---|---|
| 1 | 2 | 3 | 4 |
| 5 | 6 | 7 | 8 |
| 9 | 10 | 11* | 12* |
| 13* | 1* | 2* | 3* |
| 4* | 5* | 6* | 7* |
| 8* | 9* | 10* | 11* |
| 12* | 13* | 1* | 2* |
| 3* | 4* | 5 | 6 |
| 7 | 8 | 9* | 10* |
| 11* | 12* | 13* | 1* |
| 2* | 3* | 4* | 5* |
| 6* | 7* | 8* | 9* |
| 10* | 11* | 12* | 13* |
| 1* | 2* | 3 | 4 |
| 5 | 6 | 7* | 8* |
| 9* | 10* | 11* | 12* |
| 13* | 1* | 2* | 3* |
| 4* | 5* | 6* | 7* |
| 8* | 9* | 10* | 11* |
| 12* | 13* | 1 | 2 |
| 3 | 4 | 5* | 6* |
| 7* | 8* | 9* | 10* |
| 11* | 12* | 13* | 1* |
| 2* | 3* | 4* | 5* |
| 6* | 7* | 8* | 9* |
| 10* | 11* | 12 | 13 |

| | | | |
|---|---|---|---|
| 1 | 2 | 3* | 4* |
| 5* | 6* | 7* | 8* |
| 9* | 10* | 11* | 12* |
| 13* | 1* | 2* | 3* |
| 4* | 5* | 6* | 7* |
| 8* | 9* | 10 | 11 |
| 12 | 13 | 1 | 2 |
| 3 | 4 | 5 | 6 |
| 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 1 |
| 2 | 3 | 4 | 5 |
| 6 | 7 | 8 | 9 |
| 10 | 11 | 12 | 13 |
| 1 | 2 | 3 | 4 |
| 5 | 6 | 7 | 8 |
| 9 | 10 | 11 | 12 |
| 13 | 1 | 2 | 3 |
| 4 | 5 | 6 | 7 |
| 8 | 9 | 10 | 11 |
| 12 | 13 | 1 | 2 |
| 3 | 4 | 5 | 6 |
| 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 1 |
| 2 | 3 | 4 | 5 |
| 6 | 7 | 8 | 9 |
| 10 | 11 | 12 | 13 |

Our space will not permit us to give further examples or to discuss further the meaning and use of the numerals. But before closing we would ask the reader to turn again to our table No. VII. showing the period indicated by the characters on Plates XX—XXIII. As we see, this embraces part of two cycles, and includes parts of at least three Katuns. If I am correct, it will then include a period of time which was considered notable by that people. If

we turn to Plate XXXIII, where Cauac is the ruling character, we find, as I think, in the figures of the upper compartment, and in its ground-color, which is of a brownish or twilight tint, indications of the close of some important period of time. We see Ahau with a fiery red face sinking out of sight in the lower, left-hand corner, casting back, as represented by the torch in his hand, his fiery beams as he sinks below the western horizon. We say "sinks below," because, just above is another (headless) figure on which is the character Caban or Cab which signifies "to descend," and the machete. The dark figure to the right drops ten white balls, to the last or upper of which he points one finger; while just above it we see a single dark one, with a slender streak of light in it, just leaving the hand. If we cast our eyes over the Cauac column of the tables we see that *ten*, of the first cycle, is followed by *one*, of the second. This 10 corresponds with the 10 Cauac year in the next to the last group in Table XI. To the left, and directly in front of the face of the dark figure, are two characters connected, the lower one Cauac, the upper a rather unusual form of Ix. We have in this a symbol of the meeting of the two periods, the one ending with 13 Ix the other commencing with 1 Cauac.

The most conspicuous object in the compartment is the bright blue figure in the upper left-hand corner, on a black ground, surrounded by a white bordering which is crossed by dotted rays, each ending with a small round character. By counting, we find there are just twenty-three of these rays, but exactly where the dagger crosses to the eye, is a space for one more—the 24th. One year more will complete the Ahau and then its light will go out forever.

If we notice the single red dot over the second Canac character in the left-hand column of this Plate (XXIII), we observe that it is surrounded by a circle of dots, indicating its importance in some respect.

We might go on to show that the figures in the upper compartments of the four Plates XX—XXIII all relate to the close or commencement of some important period, but our limits will not permit of this, moreover our only object in presenting the foregoing is to call attention to the evidence of the following conclusions:

1st, That the work is a religious calendar of some kind; 2d,

that the day characters are used for the purpose of designating the days and not for the significations for the words; 3d, that Landa's characters for the days are at least substantially correct; 4th, that the columns composed of these characters are to be read from the top downwards; 5th, that the red numerals refer to the days or years of the week; and 6th, that the black numerals in connection with the day characters, as well as those in the spaces usually refer to the numbers of the month. There are some apparant exceptions, but I have ascertained, as I can show, that these are only apparent and not real exceptions. I may also add that we have in what has been shown strong evidence that Perez was right in asserting that the Ahau consisted of 24 years.

I have succeeded in deciphering a number of the hieroglyphics of the text but will not enter upon an explanation of these at present, as I have only commenced this part of the work.

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## EDITORS' TABLE.

EDITORS: A. S. PACKARD, JR., AND E. D. COPE.

The recent attempt on the life of the President of the United States naturally leads to reflections on the mental condition of the author of the crime. It is profitable to look into the question involved in the words insanity and responsibility, as expressed in terms of mental science.

The clearest classification of the mental faculties arranges them under the three heads of the affections or emotions, the intellect, and the will. It is held that through the mutual actions of the qualities of these three divisions, the acts, ordinary and extraordinary, are produced. The affections include the tastes or tendencies of the individual, which determine primarily the general direction of conduct. The intelligence furnishes the mode and means of execution, besides directing the affections through the light it throws on ends, as well as means. For those who do not believe that the doctrine of the directive power of the strongest inducement, covers the whole ground, the will is supposed to choose between the motives offered by the two classes of faculties first named.

Experience shows that the mind may be disordered in one of these departments and not in another, or in only one, sometimes

a very subordinate, subdivision of either one of them. Emotional insanity may coëxist with unimpaired intelligence, and *vice-versa;* but when one class of faculties is involved, it is usual for the other to be more or less affected. So closely are they interwoven in practice, that it is not easy to unravel the insane thread from the fabric of the actions, and assert that the disorder is located in this or that region of the mental machine. To do this successfully is one of the future possibilities of a completed metaphysics.

The history of Guiteau, as reported in the daily papers, clearly indicates affectional disorder. He is evidently a person more or less insensible to the ordinary feelings of benevolence, and sympathy with his kind. His general dishonesty in questions of property, is also in evidence. The manner of his matrimonial ventures indicates the same. His regardlessness of the opinion of his fellowmen is an indication of affectional deficiency. Ingenuity and ability in the execution of his preferences, indicate that a part at least of his rational faculties are sound. Guiteau is however subject to the control of what is termed "the fixed idea," which is probably at root an emotional disorder, though it has the appearance of disease of the power of ratiocination. The mind becomes possessed of an idea to which it clings in spite of powerful counter-inducements, whether arising from the part of reason or feeling. This is probably because of some peculiar pleasure experienced in its possession. Excessive feeling controlling reason, is its usual phase, but it may sometimes be due to a defect of reason alone in some particular. In that case, however, there must be less of energy and tenacity in the idea. If Guiteau correctly represents himself, the enthusiasm for the performance of a great deed to benefit a great country, and destined to confer lasting fame upon himself, as an instrument in the hand of God, has excluded all opposing thoughts. Here now is sufficient evidence of great defect of the rational faculties. Regardlessness of consequences alone cannot be so construed, for all true heroism displays it; but the utter insufficiency of the premises on which the act was based, is evidence of a mind ready to yield to the influence of any excessive fancy or enthusiasm that possesses it.

It is true that many persons accounted sane, possess prejudices which are but forms of the "fixed idea." All persons at times allow tastes, affections and emotions to usurp control over reason, whose useful servants they should be. Lack of benevolence is not always accounted an indication of insanity, although it may be displayed in cases where good sense would indicate a different course of action. Some men under the influence of dyspepsia, and women at the menstrual period, display abnormal emotional irritability. The persistence of those states, happily temporary, would be a form of emotional insanity. But it is unnecessary to adduce further evidence that the boundary-line between sanity and

insanity is not a clear one, and that the attempt to draw it sharply is futile.

In like manner we will not attempt to fix responsibility for these states and their outcoming acts. It is too deep a question for the present state of science, and so we leave it. Practically, men hold one another responsible, and properly so, but charity and truth require that we do not attempt to draw a line which human vision cannot determine. There is another view to be taken of the matter, which is accordant with philosophy and effective in practice. The mind of the so-called insane are as open to the influence of motives as are those of the sane. If those motives are known, supply them in order to produce results. Pains and penalties affect the insane, though perhaps in different kind and degree, from those that control the sane. For the benefit of other disordered minds, if not for that of the guilty person, let them be inflicted. This will not be in a spirit of revenge, but in benevolent consideration for the greatest good of the greatest number.

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## RECENT LITERATURE.

De Quatrefages' The Human Species.[1]—We looked forward with some degree of interest to the reception of this book, desirous to know how the author, who is well known to be conservative and an opponent of Darwinism as such, would look upon the question of man's origin from a savage state, and his antiquity, and other controverted anthropological topics. A perusal of the book, the interest of which is sustained from beginning to end, convinces us that the author by his fairness, sagacity and general culture, and scientific spirit, is uncommonly well qualified to express his opinion on mooted questions. The subject is treated in a comprehensive way and with the methods of the zoölogist, the author being distinguished for his anatomical work upon the lower animals. While disposed to ascribe to animals innate sense, consciousness and reason, and allowing that from an anatomical point of view "there is less difference between man and the superior order of apes, than between the latter and the inferior orders," and allowing that it is not "in the phenomena connected with the intelligence that we shall find the basis of a fundamental distinction between man and animals," he proceeds to place man in a separate kingdom from the animal kingdom, because of his moral and religious faculties. From this point of view he studies man, and discusses his relations as a species divided into numerous races, his origin, antiquity and original birth-place, his migrations from his specific center, and the steps

[1] *The Human Species.* By A. De Quatrefages, Professor of Anthropology in the Museum of Natural History, Paris. The International Scientific Series, New York, D. Appleton & Co., 1881. 12mo, pp. 498. $2.00.

in his acclimatization as he moved out in successive waves of migration from his birth-place. Our author then studies primitive man, the fossil human races, and finally discusses the physical and psychological characters of the present human races. From this sketch it will be seen in what a comprehensive way De Quatrefages has viewed the subject.

After endeavoring to prove the unity of the human species, a topic upon which there is now but little disagreement, he discusses Darwinism, and, while he accepts the doctrine of natural selection, claims that we have not yet discovered any *vera causa* of transmutation of species, though expressing his willingness to accept a theory of evolution when a good working one is discovered. He meanwhile strongly insists upon the fact that the early races of man have been modified during their migrations, and that the prehistoric races have been acted upon by climatic changes; thus far De Quatrefages is an evolutionist. His criticisms of Darwin's missing links, of Huxley's pithecoid man, of Wallace's views, are candid and some of his opposing views are certainly weighty.

As to the antiquity of man, De Quatrefages agrees with those who trace him back to miocene times, or to use his own, emphatic words, "Man was most certainly in existence during the quaternary epoch and during the transition age, to which the gravels of Saint Prest and the deposits of the Victoria cave belong. He has, in all probability, seen miocene times, and consequently the entire pliocene epoch" and, he adds, man may "have been contemporaneous with the earliest mammalia, and go back as far as the secondary period."

While, simply for want of evidence, discarding the views of Darwin and Haeckel, as to the origin of man from some lower mammal, and indulging in no speculations of this sort, he still applies to man Darwin's theory of natural selection and the principle of the struggle for existence among the different races.

After tracing briefly the history of the Aryan race, its origin on the southern slopes of the central Himalayas, in a region where the summer lasted only two months, and indicating the route this hardy race followed as it decended into Bokhara, and overrun Persia and Cabul before reaching the basin of the Indus, and finally reached the Ganges, and showing how this prepotent race overran the world until it has gradually become acclimatized from the poles to the tropics, he graphically compares the beginning of the human race to that of the far later Aryan race, in the following words:—

"The human species must have made a beginning like the Aryans. Upon leaving their center of creation, it was by slow stages that the primitive colonists, ancestors of all existing races, marched forth to the conquest of the uninhabited world. They thus accustomed themselves to the different conditions of existence

imposed upon them by the north, the south, the east, or the west, cold or heat, plain or mountain. Diverging in every direction, and meeting with different conditions of life, they gradually established a harmony between themselves and each one of them. Thus acclimatization, advancing at the same rate as geographical conquest, was less fatal. The struggle, however, though mitigated indeed by the slowness of the advance, still existed, and many pioneers must have fallen upon the route. But the survivors had only nature to face, and, therefore, succeded, and peopled the world."

The studies of our author and the facts he presents are extremely interesting, as well as original and most valuable to the zoölogist. How he looks upon primitive man may be seen by another extract, which reads as if written by a confirmed evolutionist.

"The primitive type of the human species must necessarily have been effaced, and have disappeared. The enforced migrations, and the actions of climate, must of themselves have produced this result. Man has passed through two geological epochs; perhaps his center of appearance is no longer in existence; at any rate, the conditions are very different to those prevailing when humanity began its existence. When everything was changing round him, man could not avoid being changed also. Crossing also, has certainly played its part in this transformation."

He adopts De Salles idea that the earliest men had red hair, and that the present cases of races and individuals with red hair, and a yellow skin, as in the case of mulattoes, are examples of atavism. The primitive man probably had a prognathous jaw, and his language was a more or less pronounced monosyllabic one, though these are only conjectures. He believes farther, that while man did not enter the world with the innate knowledge and instincts of animals alone, still less did he appear in a fully civilized state "mature in body and mind;" he had only the aptitudes which were destined to undergo the marvellous development of later times.

The chapters on the action of conditions of life and heredity, will satisfy most of our readers as they are, whether the author will admit or not, simply modern Lamarckianism. De Quatrefages insists that "the first causes of variation are, *conditions of life and heredity*. In phenomena of this kind, conditions of life act as the supreme ruler. If they vary, they become modifying agents, if they remain constant, agents of stabilization. In both cases their result is to harmonize organisms with the conditions of their existence. Heredity, which is essentially a preserving agent, becomes an agent of variation when it transmits and accumulates the modifying actions of the conditions of life."

De Quatrefages in opposition to Lubbock and others claims,

with citations of numerous authorities, that the lowest of existing savages, such as the Australians, have a moral sense and ideas of a God, and that so far as we know the earliest prehistoric races had the religious sense and an idea of a hereafter, as shown by the burial of their dead.

The book, though published in the present year, must have been prepared several years since, as it is strangely deficient in references to recent discoveries in American anthropology, such as Wyman's works, the discoveries of Professor J. D. Whitney in California and several other prominent archæologists, but still the work is a most useful and valuable one, in many respects written from an advanced standpoint, and the author distinguishes, as is not always done by modern anthropologists, between reasonable inductions and simple conjectures.

THE ZOOLOGICAL RECORD FOR 1879.[1]—This volume, though not paged consecutively, contains about as many pages as any of its predecessors, and is rather more bulky than the Record for the three preceding years. According to a notice in *Nature*, about 1000 new species were described during 1879 and are recorded in this volume; this shows a remarkable activity among the systematic zoölogists. Numerous and important changes have occurred in the editorial staff. The volume continues to be edited by Mr. E. C. Rye, but the deaths of Messrs. Alston and O'Shaughnessy, and the unfortunate resignation of Dr. Lütken of Copenhagen, who has so long and so ably edited the Echinoderms and Cœlenterates, is a serious loss to the list of editors; their places, however, have been, so far as we see, well supplied by younger men, and the Record still remains an indispensable reference book for zoölogists. As we have repeatedly said, those American zoölogists or entomologists, who live out of reach of libraries, would do well to own the volumes as they annually appear. The Record for 1880 is promised to subscribers in the course of the present year. Meanwhile the work of the editors will be greatly facilitated and the list of zoölogical papers and of new species and genera more perfect if American authors would think to send copies of their articles to the editor, care of Mr. Van Voorst, 1 Paternoster Row, London.

OUR SPORTING JOURNALS.[2]—No country can boast of better conducted sporting journals than the United States. The extent of our country furnishes many varieties of sport, and all are well represented by agreeable correspondents from every section of the continent. An important function of these periodicals, and one which they are effectively performing, is the preservation of the

[1] *The Zoological Record for 1879;* being volume sixteenth of the Record of Zoological Literature. Edited by EDWARD CALDWELL RYE, London, 1881. 8vo.

[2] *Afield and Afloat*, Philadelphia, 16 pp. *The American Field*, New York and Chicago, 28 pp. *The Forest and Stream* and *Rod and Gun*, New York, pp. 22. *The Chicago Field*, Chicago, 24 pp.

native fauna of the country. No one is more solicitous for the protection of our wild animals than the true sportsman. Without them, indeed, his occupation would be gone. It is through the pressure brought to bear by gentlemen represented by these journals, that such protective legislation as we have, has been obtained. In their pages we constantly find protests against the murderous practices of a class of hunters who care for nothing but the gratification of the instinct of destruction, and who would, if not suppressed, reduce the world to a condition as lifeless as that of our unfortunate neighbor the moon.

A valuable feature of these journals is the scientific element which enters into them. They all have a department devoted to exact information, which is generally edited by some competent scientist. In this, as in other respects, the NATURALIST recognizes in these journals natural allies in the work of interesting and instructing in the facts of nature. By these facts we live, enjoy, suffer and die; and the knowledge of them is a most agreeable combination of the *utile* with the *dulce*.

REPORT OF THE GEOLOGICAL SURVEY OF CANADA FOR 1878–79.[1] This volume possesses special interest from the large amount of novel information it gives regarding the geology and physical geography of British Columbia and of the region lying west of Hudson's bay. While the survey work has gone on in Canada, Nova Scotia and New Brunswick, having been performed in the latter province by Messrs. Bailey, Matthew and Ells, British Columbia has naturally, from the recent discovery of coal and gold mines, received of late particular attention. Mr. G. M. Dawson has had charge of this region. His report relates to the Queen Charlotte islands. He believes that two periods of glaciation have occurred on these islands, the second less intense, consisting of a temporary advance of glaciers from the various mountain systems. Mr. Robert Bell's report of his explorations of the Churchill and Nelson rivers, and around God's and Island Lakes is a continuation from the previous volume of his account of this vast and little known region. The remarks on the northern limits of forest trees in British America and on forest preservation will be of much permanent value, as well as the zoölogical and botanical appendices in the volume. To anthropologists the chapter by Mr. Dawson on the habits and architecture of the Haida Indians will prove well worth examining and of permanent value.

RECENT LITHOLOGICAL NOTICES.—In a brief paper on the age of the copper-bearing rocks of Lake Superior, which is extracted from the Proceedings of the American Association for the Advancement of Science, Boston Meeting, 1880, Mr. M. E. Wads-

[1] *Geological Survey of Canada.* ALFRED R. C. SELWYN, F. R. S., F. G. S., Director. Report of Progress for 1878–79. Montreal, Dawson Brothers, 1880. 8vo, with Maps and Plates.

worth thinks he has proved that the eastern sandstone conformably underlies the copper-bearing rocks, and that both are of the same geological age, and that the evidence brought forward by Dr. Rominger until disproved, shows that Messrs. Foster and Whitney were correct in regarding it as of Potsdam age.

Two other papers by Mr. Wadsworth appear in the Geological series of the Bulletin of the Museum of Comparative Zoölogy, (Nos. III, IV, May 1881). No. III is on an occurrence of gold in Maine, at Sullivan, Hancock county. No. IV, is of considerable interest, being a microscopical study of the iron ore, or peridotite of Iron Mine hill, Cumberland, R. I. The rock is similar to the celebrated iron ore of Taberg, Sweden, which has been worked for over 300 years. As it was impossible by field observations to determine the origin of the rock, Mr. Wadsworth concludes that it is most probably eruptive in its nature. This examination may serve, the author adds, as an illustration of the aid that microscopical lithology may be to the practical side of life.

THE ECONOMIC ENTOMOLOGY OF ONTARIO, CANADA.[1]—This is one of a series of reports which have been annually issued since 1870 by a Society which has done much good, both in the Provinces and in the United States, towards compiling and diffusing a knowledge of the habits of our more injurious insects. These reports are mostly made up of compilations from American authors, and while the scientific organ of the Society, the *Canadian Entomologist*, which has many contributors in the States, publishes much that is new about our common injurious insects, it would be well if our Canadian friends could find the opportunity to make and publish in their Annual Report original observations, for the field is a wide one, and original observers are sadly needed.

THE GEOLOGY OF INDIANA.[2]—While the larger proportion of this report is devoted to statistics and allied subjects, about one hundred pages bear upon the geology and palæontology of the State, the latter comprising descriptions of the more characteristic fossils of Indiana, by Dr. C. A. White, adapted for the use of the public and beginners in the study.

RECENT BOOKS AND PAMPHLETS.—Klassen und Ordnungen des Thier-Reichs. Dr. H. G. Bronn, Fortgesetzt von C. K. Hoffmann, Prof. in Leiden. Sechstes Band, III, Abtheilung. Reptilien, 16. und 17. Lieferung. 12vo, pp. 68, 3 plates. Leipzig und Heidelberg, 1881. From the editors.

Simosaurus pusillus, aus der Lettenkohle von Holeneck, von Dr. Oscar Fraas. Separat-Abdruck ans den Württemb. Naturw. Jahresheften, Jahrg. 1881. 8vo, pp. 6, 1 plate. From auth r.

Paleoethnologie de L'Antiquité de L'Homme dans les Alpes-Maritimes, par Emile Rivière. Planches en chromo-lithographie par J. Cillay. Gravures sur Bois par Guzman. 4vo, pp. 31, IV, plates. Paris, 1881. From the author.

[1] *Annual Report of the Entomological Society of the Province of Ontario for the year 1880.* Printed by order of the Legislative Assembly, Toronto, 1881. 8vo, pp. 89.

[2] *Second Annual Report of the Department of Statistics and Geology, 1880.* (By JOHN COLLETT, Chief of Bureau.) Indianapolis, 1880. 8vo, pp. 544.

Sur les plus anciens Reptiles trouvés en France. Par M. A. Gaudry. 4vo, pp. 4. Paris 1881. From the author.

Note sur une Nouvelle et Très Petite espe e de Musaraigne, de Madagascar. Par le Dr. E. L. Trouessart. 8vo, pp. 12, 1 plate. Paris, 1881. From the author.

Revision synoptique du Genre Semnopitheque (Semnopithecus) et description de quelques especes rares au peu connus. Par le Dr. E. L. Trouessart. 8vo, pp. 33. Paris, 1881. From the author.

Horse, Part I, Zoölogy and Anatomy. Prof. W. H. Flower. 8vo, pp. 12, cuts. Reprint from Encyclopedia Britanica, 1881. From the author.

On the Male Generative organs of the Sumatran Rhinoceros (Ceratorhinus sumatranus). By W. A. Forbes, B. A., F. L. S., Scholar of St. John's College, Cambridge, Prosector to the Society. From the transactions of the Zoological Society. 4to, pp. 4, 1 plate. Cambridge, 1881. From the author.

On the Elephant Seal (Macrorhinus leoninus Linn) by William H. Flower, LL. D., F.R.S., P.Z.S., &c., &c. From the proceedings of the Zoological Society of London. 8vo, pp. 17. London, 1881. From the author.

On the Bursa Fabricii in Birds. By W. A. Forbes, F.Z.S. From proceedings of the Zoological Society of London. 8vo, pp. 15, cuts. London, 1881. From the author.

On some points in the structure of Nasiterna, bearing on its Affinities. By W. A. Forbes, B.A., F.L.S., Scholar of St. John's College, Cambridge, Prosector to the Society. From the proceedings of the Zoological Society of London. 8vo, pp. 2. London, 1880. From the author.

Contributions to the Anatomy of Passerine Birds, Part I. On the structure of the stomach in certain genera of Tongers. By W. A. Forbes, B.A., F.L.S., Scholar to St. John's College, Cambridge, Prosector to the Society. Proc. Zool. Soc. 8vo, pp. 6, cuts. London, 1881. From author.

Contributions to the Anatomy of Passerine Birds, Part II. On the Syrinx and other points in their Anatomy of the Eurylæmidæ. By W. A. Forbes, B.A., F.L.S., Scholar of St. John's College, Cambridge, Prosector to the Society. From the proceedings of the Zoological Society of London, May 4, 1880. 8vo, pp. 8, cuts. London, 1880. From the author.

Contributions to the Anatomy of Passerine Birds, Part III. On some points in the structure of Philepitta, and its position amongst the Passeres. By William A. Forbes, B.A., F.L.S., Prosector to the Society. Proceedings Zool. Soc., 1880, No. XXVI. 8vo, pp. 6, cuts. Cambridge, 1881. From the author.

On some points in the Anatomy of the Koala (Phascolarctos cinerus). By W. A. Forbes, B.A., F.L.S., F.Z.S., Prosector to the Society. From the proceedings of the Zoological Society of London, Jan. 18, 1881. 8vo, pp. 18, cuts. London, 1881. From the author.

Note on Mr. Barlett's communication on the habits of the Darter. By W. A. Forbes, B.A., Prosector to the Society. From the Zoological Society of London. February 1, 1881. 8vo, pp. 1. London, 1881. From the author.

On the Anatomy of Leptosoma discolor. By W. A. Forbes, B.A., F.L.S., Prosector to the Society. From the proceedings of the Zoological Society of London. June 15, 1880. 8vo, pp. 10, cuts. London, 1880. From the author.

On the Anatomy of the African Elephant (Elephas africanus Blum.). By W. A. Forbes, F.Z.S., F.L.S. From the proceedings of the Zoological Society of London. May 6, 1879. 8vo, pp. 18, cuts. London, 1879. From the author.

On the External Characters and Anatomy of the Red Uakari Monkey (Prachyurus rubicundus), with remarks on the other species of that Genus. By W. A. Forbes, B.A., F.L.S. Fellow of St. John's College, Cambridge, Prosector to the Society. From the proceedings of the Zoological Society of London, November 30, 1880. 8vo, pp. 26, 3 plates, cuts. London, 1880. From the author.

Note on a specimen of Denham's Bustard (Eupodotis denhami). By W. A. Forbes, B.A., F.L.S., Prosector to the Society. From the proceedings of the Zoological Society of London, June 15, 1880. 8vo, pp. 2. London, 1880. From the author.

On the contributions to the Anatomy and classification of Birds, made by the late Prof. Garrod, F.R.S. By W. A. Forbes, B.A. Fellow of St. John's College, Cambridge, Prosector to the Zoological Society of London. The Ibis. Fourth Series, No. XVII, January, 1881. 1. London, 1881. From the author.

Reports of Geological Explorations during 1879–80. With maps, and sections. James Hector, C.M.C., M.D., F.R.S., Director. Published by command. Gov. Printing Office, Wellington, New Zealand. 8vo, pp. 166, maps, cuts. Wellington, 1881. From the author.

Annual Report of the Board of Regents of the Smithsonian Institution, showing the operations, expenditures, and condition of the Institution for year 1879. 8vo, bound, pp. 631, cuts. Gov. Printing Office. Washington, 1881.

The Paleontologist, June 10, 1881. Contributions to Paleontology, fossils of the Lower Silurian formation, Ohio, Indiana and Kentucky. By U. P. James. 8vo, pp. 8. Cincinnati, 1881. From the author.

The Panama Canal and the Isthmus. By Col. James Worrall. Reprint from the Engineer's Club of Philadelphia. Vol. II, No. 2, 1881. 8vo, pp. 8. Philadelphia, 1881. From the author.

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New Species of Fossils and Remarks upon others from the Niagara Group of Illinois. By S. A. Miller. 8vo, pp. 12, 1 plate. Cincinnati, 1881. From the author.

The Mica Veins of North Carolina. By W. C. Kerr, State Geologist, Raleigh, North Carolina. From the Transactions of the American Institute of Mining Engineers. 8vo, pp. 6, cuts. New York, Feb., 1881. From the author.

The structure, affinities and species of Scolopendrella. By John A. Rider. 8vo, pp. 8, cuts. From the proceedings of the Natural Sciences of Philadelphia, 1881. Philadelphia, 1881. From the author.

Proceedings of the United States National Museum. 8vo, pp. 40, 1881. Washington, 1881.

Memoirs of the Peabody Academy of Science, Vol. I, No. V. 4to, pp. 14, 2 plates. Salem, Mass., 1881. From the academy.

Memoirs of the Peabody Academy of Science, Vol. I, No. VI. 4to, pp. 20, 1 plate. Salem, Mass., 1881. From the academy.

Illustrations of the Nests and Eggs of Birds of the United States. With Text. By Thomas G. Gentry, 4to, pp. 6, 2 plates. Part 8. Philadelphia, 1881. From the author.

Illustrations of the Nests and Eggs of the Birds of the United States. With Text. By Thos. G. Gentry, 4to, pp. 14, 2 plates. Part 9. Philadelphia, 1881. From the author.

Gill-Nets in the Cod Fishery, etc. U. S. Commission of Fish and Fisheries. By Capt. J. W. Collins. Bulletin U. S. Fish Commission I, April, 1881. Washington, 1881.

Report of the State Commissioners of Fisheries for the years 1879 and 1880. 8vo, bound, pp. 151, cuts. State Printer, Harrisburg, 1881.

Notes on North American Microgasters with descriptions of new species. By C. V. Riley, M.A., Ph.D. From the Transactions of the Academy of Science of St. Louis, Vol. IV, No. 2. 8vo, pp. 20, cuts. St. Louis, April 6, 1881. From the author.

Johns Hopkins University, Baltimore. Studies from the Biological Laboratory. Editor H. Newell Martin, M.A., D.Sc, M.D. Associate Editor, W. K. Brooks, Ph.D., Vol. II, No. 1. Johns Hopkins University, June, 1881. From the editors.

Illinois State Laboratory of Natural History. Bulletin No. 4. Catalogue of Birds of Illinois. By Robert Ridgeway, Bloomington, Ill. 8vo, pp. 208, May, 1881. From the author.

A Report of twenty years' experience in the Department of Physical Education

and Hygiene in Amherst College. To the Board of Trustees. By Edward Hitchcock. 8vo, pp. 16, table. Amherst, Mass, 1881 From the author.

Ward's Natural Science Bulletin. 4to, pp. 16, cuts. New York, June 1, 1881. From the author.

On an occurrence of Gold in Maine. By M. E. Wadsworth. 8vo, p. 1, No. 3.

A Microscopical study of Iron Ore, or Peridotite of Iron Mine Hill, Cumberland, Rhode Island. By M. E. Wadsworth. 8vo, pp. 6, No. 4. From the Bulletin of Museum of Comparative Zoology, at Harvard College, Cambridge, Mass., May, 1881. From the author.

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## GENERAL NOTES.

### BOTANY.[1]

THE POISON OF ZYGADENUS PANICULATUS.—A partial report from the Government chemist, shows that the bulbs of *Zygadenus paniculatus* Watson, have a glucosid to which their poisonous properties are attributed. Convulsions and speedy death follow the eating the bulbs of this plant. No antidote is yet known for it.—*M. E. Jones, Salt Lake City.*

GERMINATION OF ASTRAGALUS UTAHENSIS.—While gathering plants on the mountains near Salt Lake City (Utah Territory), I was very much puzzled by seedlings of our beautiful *Astragalus Utahensis* T. and G. It grows in the sand, first throwing up its small cotyledons, then producing two large round, woolly, simple leaves one inch in diameter, on a petiole often three inches long; after these comes another pair of similar leaves; then another with two leaflets on the long petiole, then another with either two leaflets (one on the end of the petiole and the other on one side), or three leaflets in the true odd-pinnate style; the next pair with either three or five, the next with five or seven, and so on. It is a long while after the germination of the seeds before one would suspect that it is an Astragalus, or even a member of the Leguminosæ.—*M. E. Jones, Salt Lake City.*

HOW OUR RED CLOVER BEHAVES.—In 1879 our crops of red clover *(Trifolium pratense)* were very luxuriant. After the haying season it made a second growth, in many instances little inferior to the first, and the seeds ripened very perfectly. But to the surprise of all the farmers hereabouts, the following spring (1880) found the clover seed completely killed out! This was very much of a discouragement to many of us who had but recently begun the cultivation of this excellent fodder plant in our comparatively new part of country. Our clover died, no doubt, from severe freezing in the winter of 1879–80, after a period of very great dryness during the latter part of summer, and all of the autumn. But little snow fell in the winter, so that the plants were without the protection which it usually affords. We all thought, however, that the seeds would germinate in the spring,

[1] Edited by PROF. C. E. BESSEY, Ames, Iowa.

and produce a new set of the plants. But this did not occur, and in many meadows where the clover had been thickest, there were bare patches of ground all summer long. As clover is usually sown with timothy *(Phleum pratense)*, this last species thickened up and largely supplied its place, so that the hay crop was generally a fine one. During the spring of 1880 there was less than the usual amount of moisture in the soil, while the summer and early autumn were excessively dry. This diminution of moisture no doubt kept the clover seeds from germinating until this spring, when the ground is full of moisture. To the surprise of most people now, after the seeds have lain upon the ground two winters and one summer, they have germinated, and promise to make our meadows as luxuriant with clover as they were in 1879, and previous years! The little plants have sprung up by millions, simultaneously with that sown only a few weeks ago. They are so numerous that probably not one in a score will live. But through the unerring processes of "natural selection," only the fittest will survive; and what is of more practical moment, this unlooked for result will gladden the hearts of our farmers, who were sorely disappointed in the spring of 1880, to find that their clover did not wake up from its long winter sleep.—*Charles Aldrich, Webster City, Iowa, May 17, 1881.*

Sets of North American Algæ.—Several years ago Dr. Farlow, Dr. Anderson and Professor Eaton began the publication of sets of the marine algæ of the eastern and western coasts of North America. The first fasciculus of fifty species appeared in 1877; the second also containing fifty species in 1878; the third containing thirty species in 1879. The fourth fasciculus has just been issued (June), and like the first and second, it includes fifty species. It may well be said that it is impossible for any one to get anywhere more satisfactory representatives of the one hundred and eighty species already included in this important distribution. Not only are the specimens all that can be desired, but the eminent qualifications of the editors for this work, give an unusual value and high authenticity to the sets. We are glad to learn that this work has been fully appreciated by botanists, and have been told that it is now impossible to get copies of the first fasciculus, all having been disposed of. The separate fasciculi, however, are valuable, even if all cannot be obtained, and botanists in charge of college herbaria could hardly do better than to secure one or more of them, especially Fasciculus III, which is composed mainly of the larger species, such as Sargassum and its allies.

Botanical Notes.—Centuries VI and VII of Ellis' "North American Fungi" appeared during the last few days of May. Like their predecessors, these two centuries consist of well selected specimens, from nearly all of the groups of the fungi. Thus in Century VI, there are of Basidiomycetes, 22 species, As-

comycetes 44, Myxomycetes 1, and of the so-called imperfect fungi 33. In Century VII, there are of Basidiomycetes 13, Ascomycetes 42. Mixomycetes 2, miscellaneous species and imperfect forms 43. These five sets, which now aggregate 700 species, are well nigh indispensable to the botanist who wishes to intelligently study the lower plants. Their cheapness ($7 per Century, mounted and labeled), ought to commend them to the curators of college herbaria.——Professor Spalding, of the University of Michigan, has reprinted from the *Therapeutic Gazette*, an interesting pamphlet of 16 pp. on *Ustilago maydis*, the smut of Indian corn. Several wood-cuts serve to illustrate the text.——Dr. Sturtevant has been studying the subject of seedless fruits, and has embodied his results in a paper recently printed by the Massachusetts Horticultural Society. He has brought together a large number of very curious facts.——G. E. Davenport describes in the June *Torrey Bulletin* a new fern, *Cheilanthes Parishii*, from California. An excellent plate, by Faxon, accompanies the text.——Professor Tuckeman in the same number of the *Bulletin* directs attention to a forthcoming work ("Symbolæ Licheno-Mycologicæ") by Dr. Minks, of microgonidia-fame. From the Professor's notice it appears that Dr. Minks proposes to show, not that lichens are fungi, but that many plants hitherto called fungi are in reality lichens!——Dr. Farlow also describes a Carpinus, which grew in a jar of water!——The June *Botanical Gazette* contains many valuable papers, among which are the following: Descriptions of New Plants from New Mexico and Arizona, by E. L. Greene; Chlorophyll, by Professor Coulter; Iowa additions to the N. A. Flora by Dr. Engelmann; New Species of Fungi, by C. H. Peck. Dr. Engelmann describes a new species of Conifer, *Tsuga Caroliniana*, nearly related to our common hemlock spruce. It is from the mountains of North and South Carolina.——A catalogue of the Musci of the valleys of the Serchio and the Magra (central Italy west of the Appenines), by Fitzgerald and Bottini, occupies about 100 pp. of the April number of *Nuovo Giornale Botanico Italiano*. Three hundred and sixty-nine species are noticed. Full notes as to habitat and locality accompany each entry.

## ZOÖLOGY.

Brief Notes on Some Iowa Birds.—I have heretofore stated my belief that the indigo bird (*Cyanospiza cyanea* Baird), is a summer resident of this section. I have no doubt of this—for I saw them here in our thickets on many occasions during the month of May, though I have not yet found a nest. But they sang in the tree-tops, and hunted insects as if "to the manor born;" to-day I saw another, so I concluded that their nests must be near by.

I also mentioned seeing a robin (*Turdus migratorius*) during the

"blizzard" times last winter. After my article was sent away, I repeatedly saw one, which I presumed to have been the same bird. It undoubtedly tarried with us during all of our unexceptionably severe winter. I am also reliably informed that these birds wintered in large numbers in Boone county, thirty or forty miles south of this place, that they made their homes in some of the deep ravines which extend back from the Des Moines river. In these ravines there would generally be open water from springs, about which they could doubtless pursue food, while the high timbered bluffs would very materially modify the severe climate.

A few nights ago a young friend was passing an old mill just across the river from me, with a lighted lantern. His attention was attracted to some flying creatures, which came very close to him, and which he thought at first were bats. But stopping a moment, he caught two of them, and they proved to be swallows, which had lately arrived, and were building their nests under the eaves of "that ancient mill." I read of birds being attracted by a light, and killing themselves by flying against the windows of lighthouses, or other elevated buildings, but never before of an instance of this kind.

I have often thought that there is one marked difference between the blue jays of western New York and Pennsylvania, as I knew them when a boy, forty years ago, and ours here in Iowa. In those days there were still deep woods in that region where great groves of pine and hemlock had never been disturbed by the woodman's axe. These dark recesses, miles from settlements, were favorite resorts of the blue jay, and the recollection of their far away screams and calls comes back to me whenever I hear the same notes here! But there is this difference: Our jays are very tame, almost half domesticated, coming freely to our barnyards and corn-cribs, and helping themselves, in a bold, confident way, often robbing the nest of a hen or a duck as freely as they perpetrate the same depredations upon the robins and thrushes. Some years, ago so tame are they here, the little daughter of a friend of mine saw a blue jay very busily pecking at some object, doubtless an ear of corn. Approaching stealthily, she clapped her hands upon his sides and captured him! It is amusing to see them eat a kernel of our large western corn. They cannot swallow the grains whole, and are compelled to break them into two or more pieces. This they do with powerful strokes of their bills, while holding the grain upon the ground or other hard surface with one foot. These strokes come down as systematically as a blacksmith hits a hot iron with his hammer! Often three or four blows are needed to divide the object, so it can be swallowed and the bird looks around at every stroke to see if the coast is clear. But back in western New York and Pennsylvania, they were shy and secretive, living for the most part in the grand old woods. It seems to me this difference in habits may be largely

due to the scarcity of timber in this region, which makes it a necessity for them to live near the abodes of men. As population increases, their habits of familiarity are increased, and so the blue jay has become one of the tamest and most domestic of our Iowa birds, tolerated for his beauty and sprightliness in spite of his alleged, and I fear too often apparent, depredations upon other birds.—*Charles Aldrich, Webster City, Iowa, June 11, 1881.*

THE ORGANS OF SMELL IN LAND SNAILS.—Dr. Sochaczewer has endeavored in the *Zeitschrift für wissenschaftliche Zoologie* (1880), to decide between the claims of the tentacles, the organ of Semper, and the pedal gland to be regarded as the organ of smell in land snails. It has been known for many years that the tentacles each contain a large ganglion whence radiate five fibers with the investing epithelium, giving rise to terminal knobs, endowed apparently with a sensory function. Naturalists differ as to the office of these organs, for some, like Linnæus, regard them as having the sense of touch. In order to decide the matter, Dr. Sochaczewer cut off the tentacles of *Helix pomatia*, and after the healing process was completed, the snail was placed in the center of a flat plate, the edge of which was smeared with oil of turpentine. The movements of the snail were very slow and uncertain. When it approached the edge of the plate, it behaved itself exactly as did a snail in which the tentacles were completely uninjured, returning at last to the middle of the plate, and withdrawing itself into its shell. This and similar experiments seem to show that the tentacles are not the seat of the sense of smell.

The author next considers Semper's organ, discovered by Professor Semper in 1856. Small in Helix, Arion and Lymnæus, it is best developed in Limax, where it exists in the form of four or five glandular lobes in the sides of the mouth. The author decides that this is simply a gland without any sensory function, and that the organ of smell exists in the foot-gland which is well supplied with nerves, and is of some size. The author claims that in this structure, which is situated in the middle line of the foot, are found the three necessary factors of an olfactory organ, *i. e.*, of sensory cells, the entrance of air, and the addition of a secretion from a gland. The orifice at the anterior margin allows the air to enter; the olfactive matters contained in it are mixed with the secretion, and so come in contact with the peripheral nerve-cells. The author concludes by pointing out that the sensory arrangements which obtain in the invertebrates are not to be too closely or hastily compared with those seen in vertebrate animals.—*Journal of the Royal Microscopical Society.*

THE STRUCTURE OF THE ORANG OUTANG.—Under this title Dr. H. C. Chapman has published in the Proceedings of the Academy of Natural Sciences of Philadelphia, notes of the dissection of a male orang. The author states that "the cerebellum in my orang was relatively larger than that of man, but smaller than that of

either the chimpanzees I have dissected, and was just covered and no more by the posterior lobes of the cerebrum." He closes his paper with the following remarks:

"What can be inferred from the general organization of the orang as to its relation to the other primates? The orang like man has twelve ribs, whereas the gorilla and chimpanzee have thirteen; on the other hand, the carpal and tarsal bones are nine in number in the orang, while the chimpanzee and gorilla agree with man in having eight. The upper extremity of the orang resembles that of the gorilla in the absence of the *flexor longus pollicis*. The chimpanzee and man are alike in this respect, at least the slip from the *flexor longus digitorum* in the former is functionally a *flexor longus*. In the absence of a *flexor longus hallucis*, and in the presence of an *opponens hallucis*, the orang differs from man, the anthropoids, and all the monkeys. The great blood vessels arise from the arch of the aorta in the gorilla and man in the same way; the same disposition is usually seen in the chimpanzee, rarely in the orang. The lungs in the orang are not divided into lobes, as in the gorilla, chimpanzee and man. The stomach in the gorilla and chimpanzee is human in its form; in the orang, however, it is quite different. The peritoneum in the gorilla, chimpanzee and orang is like that of man; in the lower monkeys it is different. The brain of the orang in its globular form, in the cerebellum being usually covered by the cerebrum, and in the development of the first occipital gyrus, resembles man's more than that of the gorilla and chimpanzee. On the other hand, the frontal and temporal lobes in the orang are not as much convoluted as in the chimpanzee, and still less than in man, and the island of Reil is not convoluted at all, at least in my orang.

Marine Animals in Aquaria.—The great aquarium and laboratory founded by Dr. Dohrn is exerting a decided influence on the progress of biology, as many of the leading German, English, Russian and Italian zoölogists have, owing to the unusual facilities for studying living marine animals of the Bay of Naples, produced a series of works of high interest and value. To give some idea of the facilities enjoyed by those who work at this celebrated seaside laboratory, the following account is compiled from a notice in the Journal of the Royal Microscopical Society:

Among animals breeding in the aquarium, none are so easily observed as the large crustacea and molluscs. The large crabs pair and lay eggs, though the zoëæ or larvæ, could not be reared; lobsters notwithstanding their salacity, rarely produced eggs in captivity. Of molluscs, the best breeders are species of Loligo, Sepia, Aplysia and Doris. Though many nudibranchs lay freely, their eggs never come to maturity. But many of the lower animals without any care whatever, thrive and multiply wonderfully. Compound Tunicates take the lead among these "spontaneous" productions. The graceful Botryllidæ exuberate in

both the northern and southern tanks. Compared with Ascidians, Polyzoa are not very generally distributed. Bugula is now the commonest, especially in the compartment for eels, where it flourishes along with Zoanthus and Hydractinia. Mullet and some other fishes, hurtful to various low growths, soon scour the rocks tenanted by Ascidians.

The tank allotted to Annelids affords a spectacle of great beauty and variety; in short, it is a perfect microcosm. Of its inhabitants, we can only note the young of a species of Spirorbis, a well known commensral of Palinurus. This annelid multiplies so fast that much trouble is spent in removing its tubes, shaped like a post-horn, which soon cement themselves with obstinate firmness to the glass windows of the aquarium.

Fishes, if we except Selachians, do not breed well in the aquarium. Otherwise, they are flourishing prisoners; the conditions unfavorable to their propagation have not yet been thoroughly ascertained.

The Eye-like Organs of the Skin of Certain Fishes.—M. Ussow, in the Bulletin of the Imperial Society of Naturalists of Moscow, 1879, gives an account of these singular organs in *Astronesthes*, *Argyroplicus*, *Chauliodus*, *Gonostoma*, *Maurolicus*, *Scopelus* and *Stomias*. He finds that in *Astronesthes*, *Chauliodus* and *Stomias* there are eyes, furnished with bodies analogous to crystalline lens, humor, retina, and pigment. He traces their nervous connection to the interspinal nerves. In the remaining genera he finds the structure to be much more simple. Their cavities containing only a gelatinous connective tissue. Mr. Solger observes the latter kind of bodies in the American genus *Porichthys*, and thinks them to be rudimental eyes. During the present year, Dr. Leydig has investigated the same objects, and confirms the results obtained by Ussow. He, however, holds a different opinion as to their uses. He thinks them electric organs more or less developed. It is known that they are in some of the genera at least, luminous. Dr. Günther describes an extraordinary fish of the cod family from great depths of the Atlantic, in which the eyes are replaced by a large, probably luminiferous, organ which covers the entire frontal part of the top of the skull.

Mason's Microscopic Studies in the Central Nervous System of Reptiles and Batrachians.—A third article by Dr. John J. Mason on this subject, appears in the Journal of Nervous and Mental Disease for January, 1881. The author has studied the nuclei of the spinal cord of the alligator and *Heloderma suspectum*, our largest lizard; and he reaffirms from his new studies the law previously formulated that "the nuclei of the so-called motor cells of the central nervous system have, in the same individual, average diameters, which are proportional to the power developed in the related muscles."

THE JELLY FISHES OF NARRAGANSETT BAY.—A beautifully illustrated memoir entitled "Studies on the jelly-fishes of Narragansett bay," by J. W. Fewkes, appears in the Bulletin of the Museum of Comparative Zoölogy, under date of February, 1881. It contains an account of certain new Acalephæ, collected by the author during three summers spent at Newport, with anatomical and embryological notes. As it is impossible to give an abstract of the article, we would refer the reader to the memoir itself, merely stating that a number of interesting forms originally described by Professor McCrady from Charleston, South Carolina, range as far north as Newport.

ZOOLOGICAL NOTES.—In a list of mammals collected by Dr. E. Palmer, in north-eastern Mexico, with field notes by the collector, published in the Bulletin of the Museum of Comparative Zoölogy, it is stated that the bison was killed as food by the settlers at Monclora and Parras probably half a century after the Spanish conquest. "There seems to be no reason why, so far as the nature of the country is concerned, the bison may not have ranged also to Saltillo." Dr. Palmer found no indications of the prong-horn antelope in any portion of the region he traversed. This is an important negative fact, adds Mr. Allen, as tending to fix the northern limit of this species, as it is known to occur farther westward in the northern parts of the States of Chihuahua and Sonora, while Berlandier is cited by Alston in the Biologia of Central America as authority for the statement that its range extends "southward at least throughout the State of Tamaulipas."——The *Novice*, an Austrian paper, announces the discovery, by MM. Robie and Clessen, of two new species of snails, near Predwor, in Carniola. They are without eyes, and have no need of the organ of sight, since they live in the dark, in water flowing very slowly underground. They have received from their discoverers the name of *vitrinella*, one of them, on account of its slender form, being further named *gracilis*.——It appears from a paper by Professor T. J. Bell, that of the genus Asterias (Asteracanthion of other authors), which embraces the common star fish or five finger, there are more than eighty species already described; Bell adds five to the list, and indicates how the species should in his opinion be classified.——The "sea-spiders" (Pycnogonida) dredged, under the supervision of Alex. Agassiz, by the U. S. coast steamer *Blake*, dredged along the east coast of the United States during the summer of 1880, have been described, with numerous figures, by Mr. E. B. Wilson, in the Bulletin of the Museum of Comparative Zoölogy. The remarkable feature in their deep sea forms, as in those elsewhere found, are their colossal size, compared with the shoal water forms; also, in a number of forms, the eyes (ocelli) are (1) either rudimentary and destitute of pigment; or (2) entirely absent; while on the other hand in Pallenopsis the eyes are relatively of un-

usually great size. The remarks on the morphology and innervation of the anterior appendages are excellent, and have an intimate bearing on the systematic portion of these creatures, for Mr. Wilson sagaciously remarks that "it is easily possible that the external resemblances of a Pycnogonid to an Arachnid are those of analogy only, and have no morphological significance. This is the more probable from the extreme variability of the three anterior pairs of appendages in position and structure."——In the same Bulletin Mr. S. Garman reports on the Selachians, all captured at great depths, belonging to species hitherto unknown; the results of this and other deep sea work indicate (1) that the migrations of these animals, including the fishes, are much more limited in extent than has generally been supposed; and (2) these creatures especially the skates, are more or less affected by a period of comparative inaction, in a measure corresponding to what obtains among Batrachia and Reptilia. Concerning the migrations of fish and Selachians, there are many species in our waters, the author remarks, "whose movements do not amount to more than short runs from shoal to deeper water and back again. Others would seem to extend their travels from the coasts and banks to the Gulf Stream. And still others make much more extensive migrations."——The anatomy of the African elephant is much less known than that of the Asiatic species, which is naturally far more abundant in menageries and zoölogical gardens. Messrs. Plateau and Liénard have recently published the results of the dissection of an African species, with especial reference to the heart, larynx and male reproductive organs. *Apropos* of this interesting animal, it would seem probable that Yankee perseverance and painstaking may enable us to raise our own elephants. Barnum's baby elephant, born at Philadelphia, is growing rapidly, and is a vigorous creature in its third year. Its mother is again about seven months along in pregnancy, and it is therefore not unlikely that a second one will be born in this country. The sexes in Barnum's herd of elephants pair readily in confinement. We learn on good authority that an American resident in India of thirty years, never heard of an elephant being born there, and was astonished at learning of the birth of one in the United States.——Mr. W. A. Forbes has succeeded Professor Garrod as prosector to the zoölogical society of London. He is successfully rivaling his able predecessor in the quality of his papers, which are chiefly devoted to the anatomy of mammalia and birds.——Dr. Trouessart has completed his catalogue of the mammalia as far as the end of the *Rodentia*, including that order with the *Prosimiæ* and the *Quadrumana*. The number of species is so far 2061. The catalogue will be very useful to students, as it includes synonymy and geographical distribution, as well as the extinct species.——Mr. Gentry continues his illustrated quarto work on the nests and eggs of American birds. The last plates issued are very good,

and the text is written with considerable literary ability.——Mr. Ridgway gives a list of the species of birds of Illinois which is critical and very full, including 341 species.

## ENTOMOLOGY.[1]

THE EGG-CASE AND LARVA OF HYDROPHILUS TRIANGULARIS SAY. As the nidus and young of this beetle do not appear to have been observed, a few notes gathered from an examination of several egg-cases and of larvæ hatched from them may be of interest. The cases were collected about the first of June, 1876, from a small pool of water in the Normal School grounds at this place. A half dozen were obtained floating at the surface of the water, with bits of weeds and dead leaves attached to the upper surface as floats (Fig. 1). In no case were they secured to living plants,

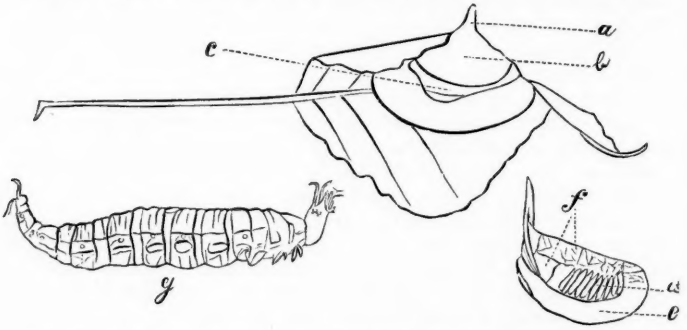


FIG. 1.—Eggs, egg-case and larva of Hydrophilus, nat. size; *a* air-tube, *b* expanded lower portion of tube; *c* opening into nidus; *d* eggs shown in vertical section of nidus; *e* empty under portion of the case; *f* chambers above eggs; *g* larva. (Garman *del.*)

as the egg-case of *H. piceus* is said to be. In one instance a female was discovered finishing her case. The last touches were being put on the expanded lower portion of the "horn" (Fig. 1, *b*), this part of the latter being then of a rich yellow color. The nidus and its maker were lifted gently in the hand and carried a distance of about one hundred yards; and so absorbed was the beetle that she continued her work, and on being put into a vessel of water finished her task. When the case was next observed the yellow material had been concealed by a brown gummy coating.

The surface of the egg-case is smooth, light brown, and resembles very closely that of the nidus of the large black and yellow spider, *Argiope riparia* (?). Viewed from above or below, the outline is a good circle. The diameter is about 20$^{mm}$, the

[1] This department is edited by PROF. C. V. RILEY, Washington, D. C., to whom communications, books for notice, etc., should be sent.

depth about $14^{mm}$. The spine-like process (Fig. 1, *a*) which arises from what may be termed the front of the case is of a dense horny nature, quite unlike the remainder of the case. It expands below into a hatchet-shaped plate (Fig. 1, *b*). The spine indeed is formed by this plate narrowing and folding backwards above the case until its edges almost meet, thus forming a partial tube, which, as will be seen later, facilitates the entrance of air into the interior. The length of the tube, as also the shape of the plate, varies somewhat. Below the hatchet-shaped expansion is a narrow opening (Fig. 1, *c*) into the case, allowing the water free passage from without and permitting the escape of the larvæ.

The eggs form a discoid mass suspended from the roof of the nidus. They are all placed vertically and arranged closely in a single layer. (See Fig. 1, *d*.) Specimens (in alcohol) are cylindrical, about $4^{mm}$ in length and about $1^{m}$ in diameter. One hundred and seven were counted in one nidus. The mass is surrounded by a rather loosely woven silken coat, while each egg is wrapped separately in a coat of similar character. Below, at the sides, and behind the mass, is left a vacant space (Fig. 1, *e*) into which the opening in front gives access to the water. The silken material above and in front of the eggs is so disposed as to form large cells (Fig. 1, *f*) and these connect with the tube through which air is admitted.

The chief object of the peculiarly constructed case appears to be to ensure a supply of air to the newly hatched larvæ. As will be seen by reference to the figures, this object is attained by excluding water from, and admitting air into, the upper part of the case, and by attaching a float to the upper surface. This keeps the top of the case at the surface of the water while the air-tube projects above.

In the very young larvæ, the head is relatively wider and larger every way than in older examples; the body is covered by a coat of short, fine pubescence, becomes gradually wider from behind forwards, and the general color is a uniform grayish-brown, becoming lighter beneath. In older examples, the body is sensibly narrowed before and behind. In the largest specimen examined, the pubescence is wanting, and there is a faint dorsal line, with a broader waved line bordered outside with dark on each side of it. The head is so attached to the body as to project obliquely upwards; it is reddish-brown, with obsolete darker shades. The mandibles and labium are narrowly edged with black. The legs are of the same color as the head. The skin is minutely roughened and deeply wrinkled. The lateral appendages of other Hydrophilus larvæ are represented by elevations so slight as to be scarcely visible. From the under side of the last segment of the abdomen in this species, arise two light-colored, cylindrical, flexible appendages, about equal in length to the first joint of the antennæ. (For the larva, see Fig. 1, *g*.)

Figure 2, *a* renders a detailed description of the mouth-parts unnecessary. A noticeable characteristic is the difference in size and shape of the right and left mandibles. The right is longer, more slender and strongly curved, and has a bicuspid prominence on the cutting edge. The left one has a single minute tooth. The maxillæ are the most prominent mouth parts, and are probably chiefly useful as palpi. They are especially large in the youngest larvæ. The terminal palpial joint and the small appendage of the second joint have areas at their apices from which arise tactile rods. The inner edges of the long basal joints of both the maxillæ and antennæ are beset with numerous straight hairs. Lateral basal prominences of the labium are roughened with minute, depressed, tooth-like processess.

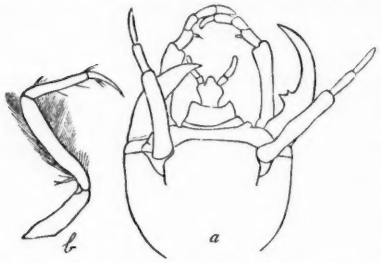


FIG. 2. — Head and leg of Hydrophilus larva, enlarged; *a*, head and mouth parts; *b*, leg. (Garman *del.*)

The legs do not vary perceptibly; all have the femora supplied with fringes of soft hair (Fig. 2, *b*).

The striking feature of the tracheal system is two large longitudinal trunks, one on each side of the middle line of the body (Fig. 3 *a*, diagram). They open in large spiracles under the posterior upper edge of the last abdominal segment but one (Fig. 3, *b*). Properly it is perhaps the antepenult, as Gegenbaur states that spiracles are never borne by the two terminal abdominal segments. The balance of authority seems to be in favor of these being the only spiracles in the larval Hydrophilus. In the case of the larvæ of two species examined this is certainly not true; for besides the large terminal pair, nine pairs of spiracles, with branches running to them from the large trunks, can be counted. One of these

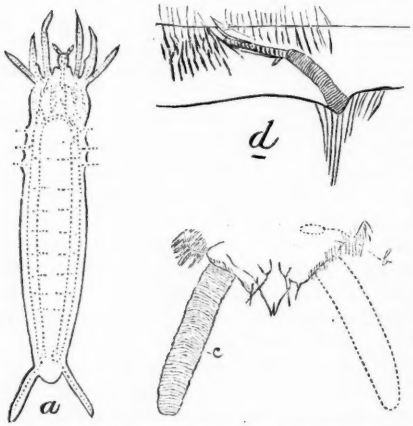


FIG. 3.—Tracheal system of Hydrophilus larva. *a*, diagram showing the main branches of tracheal system; *b*, opening of large spiracle; *c*, terminal appendage; *d*, stigmatal branch of tracheæ. (Garman *del.*)

larvæ has lateral filaments a sixteenth of an inch long, but there is no connection between them and the stigmatal branches of the tracheæ. (Fig. 3, *d*, shows one of the branches.) The latter open immediately over the large trunks some distance above the lateral filaments. They are very short, are comparatively small, pass directly upward to the skin from the trunks, and consequently a good view of them can scarcely be obtained without dissection, certainly not without rendering the specimens transparent. They can be best seen by cutting out a strip of skin above the trunks, placing it, with the air-vessels attached, under the microscope, and rolling one of the trunks aside with a needle. The first spiracles are situated in the anterior border of the mesothorax, the second in the anterior border of the metathorax, and following these there are seven others in the abdomen besides the large terminal pair, making ten pairs in all.

Westwood states that the terminal appendages of the abdomen (Fig. 3, *c*) are respiratory organs. With this statement in mind I was prepared to see them well supplied with tracheæ, and was surprised to find, instead, but a simple branch of not more than one-twentieth the diameter of the appendages.

The trunks give off numerous short branches in the abdomen and thorax near the points from which the branches proceed to the stigmata. At the posterior part of the prothorax the trunks divide, one large branch on each side continuing forward till near the front of the head, where branches are given off supplying the mandibles, maxillæ and antennæ. At about the point at which these branches leave the main branch, an arch is formed by a branch from each side curving forwards towards the middle line and there uniting. The anterior portion of this arch lies within the base of the labium, where branches pass forward from it into the labial palpi. The other branches produced by the division of the trunks form a large arch, the anterior portion of which lies within the base of the head. Branches from this arch pass along each side of the œsophagus, while others supply the sides of the head and the region of the eyes. (See diagram, Fig. 3, *a*.)—*W. H. Garman, Normal, Ills.*

## ANTHROPOLOGY.[1]

Comparative Biology.—The comprehensive term by which the study of the natural history of man is designated has become well nigh settled in its application. In the summaries which have been published in the Naturalist, the Smithsonian Report, and Baird's Annual Record, it has been found convenient to adopt the following subdivisions of Anthropology: 1. Anthropogeny, including both the laws of environment and inheritance as effecting and affecting our race; 2. Archæology, a term well understood; 3. Anatomy, specific and comparative; 4. Psychology, involuntary

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and voluntary; 5. Ethnology, including ethnography, the description and discussion of races; 6. Philology, noting the origin and elaboration of language; 7. Technics, or the manifestations of handicraft in peace and war; 8. Sociology, noting the origin and differentiation of society; 9. Religion, embracing all discussions concerning the origin and forms of the religious sentiment; 10. The description of all the instrumentalities of research, museums, libraries, journals, works of general merit, instructions to collectors, instruments of precision, and bibliography.

The term comparative biology, while really embracing all that relates to all living beings, has, in anthropology, more immediate relation with classes three and four. We have just laid aside a charming work which, in another department of zoölogy, discusses the subject of biology in these two aspects. We refer to St. George Mivart's work on the Cat, published in 1881, by Charles Scribner's Sons of New York. Indeed, as hundreds of intelligent students of anthropology, and especially of archæology, never see the inside of a dissecting room, there is no work in existence which renders familiarity with biological terminology so easy as this. The subject is always at hand, and can be examined in every stage of the great life cycle with little expense and trouble. Mr. Mivart's work in the plainest language and with excellent illustrations explains the history, form, skin, skeleton, muscles, alimentary system, circulation, respiration and secretion, nervous system, and development. In chapters XII—XV, the author discusses the different kind of cats, the cat's place in nature, its hexicology, and the pedigree and origin of the cat.

These, as previously stated, are useful to the anthropologist, who is not a physician, since they enable him to familiarize himself with the actual in nature. The portion of the volume which entitles it to mention in this department, however, is chapter XI, upon the psychology of the cat. The word "Psychology" is taken to denote all the activities, both simultaneous and successive, which any living creature may exhibit. Mr. Mivart is a dualist in metaphysics and therefore is opposed to the opinion that living beings are mere automata. On the other hand, he holds a view peculiarly his own with reference to the spiritual nature. "The *psyche*, or *soul*, is that principle of individuation which makes the animal what it is, though it has no actual existence apart from the matter it vivifies. Yet it is the animal, *par excellence*, the matter of which it is composed being but the subordinate part of that compound but indissoluble unity—the living animal." In the same chapter is a classification of the cat's *active powers* into eighteen categories, of man's into twelve, and a discussion of the scope and characters of cat language.

Had we space, it would be profitable to discuss some of the author's grounds at length, but this is one of the works on anatomy which students of anthropology cannot afford to omit.

THE BRITISH ASSOCIATION IN 1880.—The Report of the fiftieth meeting, held at Swansea in August and September, 1867, is a volume of 740 pages, with an appendix of 92 pages giving a list of members. For the benefit of reference the titles of all addresses, reports and papers bearing on anthropology, are appended:

Sixteenth and concluding report of the committee consisting of John Evans, Sir John Lubbock, Edward Vivian, George Busk, William Boyd Dawkins, William Ayshford Sanford, John Edward Lee and William Pengelly, appointed for the purpose of exploring Kent's cavern, pages 62, 575.

First report of the committee, consisting of Professor A. Leith Adams, the Rev. Professor Haughton, W. Boyd Dawkins and Dr. John Evans, on the caves of the south of Ireland, pages 209, 575.

Report of the anthropometric committee, consisting of Dr. Farr, Dr. Beddoe, Mr. Brabrook, Sir George Campbell, F. P. Fellows, Maj.-Gen. A. L. F. Pitt-Rivers, F. Galton, J. Park Harrison, James Heywood, P. Hallet, Leone Levi, Dr. F. A. Mahomed, Dr. Muirhead, Sir Rawson Rawson, Charles Roberts, Professor Rolleston, pp. 120, 625, 670.

On the site of a Palæolithic Implement manufactory at Crayford, Kent, by F. C. J. Spurrell, p. 574.

Notes on the occurrence of stone implements in the Coast Laterite, south of Madras, and in high level gravels and other formations in the South Mahratta country, by R. Bruce Foote, of the Geological Survey of India, p. 589.

DEPARTMENT OF ANTHROPOLOGY.

Address of F. W. Rudler on the Ethnology of Wales, p. 609.
On the Origin of the Malagasy, by C. Staniland Wake, p. 620.
On the Antiquities of Loughor Castle, by B. Jones, p. 620.
On Australian Autochthony, by W. Forster, p. 620.
On Drum-signalling in Africa, by Hyde Clarke, p. 620.
On a manuscript, perhaps Ghita, from W. China, by Hyde Clarke, p. 621.
Monosyllabism in philologic classification, by Hyde Clarke, p. 621.
The stone age in South Africa, by W. D. Gooch, p. 622.
An ancient settlement in the peat near Boho, Ireland, by T. Plunkett, p. 623.
On the structure of Round Barrows, Professor G. Rolleston, p. 623.
On the structure of Long Barrows, Professor G. Rolleston, p. 623.
Prehistoric times in the valley of the Rhine, Professor Schaaffhausen, p. 626.
The original Neanderthal skull, Professor Schaaffhausen, p. 626.
Palæolithic stone implement from Egypt, H. Stopes, p. 627.
Palæolithic flint instrument from Palestine, H. Stopes, p. 626.
A pocket registrator for Anthropology, F. Galton, p. 625.
On the Greek profile, J. Park Harrison, p. 625.
The flint-workers at Brandon, J. Park Harrison, p. 626.
Retention of prehistoric customs in the Pyrenees, Dr. Rhené, p. 627.
Color phenomena in Belgium and elsewhere, J. Beddoe, p. 629.
Precymric epoch in Wales, Hyde Clarke, p. 629.
Antiquity of gesture and sign language, Hyde Clarke, p. 630.
Surgery and superstition in Neolithic times, Miss A. Buckland, p. 630.
Bushmen Crania, Professor G. Rolleston, p. 631.
On the Salting mounds of Essex, H. Stopes, p. 631.
The Mountain Lapps, Lieut. G. T. Temple, p. 631.
The Hittites, W. St.C. Boscawen, p. 632.
A Bilingual seal in Cuneiform and Khita, Hyde Clarke, 633.
Prehistoric relations with gesture and sign language, Hyde Clarke, p. 635.
The Vei Syllabary of Liberia, W. Africa, Hyde Clarke, p. 635.
A Chilian tumulus, by John H. Madge, p. 636.
India the home of gunpowder on philologic evidence, Dr. G. Oppert, p. 936.

ANTHROPOLOGY IN BERLIN.—The Smithsonian Institution is in receipt of the Transactions of the Berlin Society of Anthropol-

ogy, Ethnology and Prehistory, edited by Rud. Virchow. We infer that the society holds monthly meetings, since a separate pamphlet is devoted to each meeting, as follows: Feb. 21, March 20, April 17, May 22, June 12, June 19, July 17, Oct. 16. The greater portion of the papers are on home topics, but a few relate to America:

The preparation of arrow-poison by the Pai-Ute Indians of Nevada, by Dr. W. J. Hoffman.

Precolumbian Syphilis in America, p. 225.

Stone Implements from Yucatan, p. 237.

ITALIAN ANTHROPOLOGY.—The third fasciculus of the *Archivio* per l'Anthropologia e la Etnologia, furnishes the following additions to our knowledge:

Casi di anomalie numeriche delle vertebre nell uomo, by Dr. E. Regalia.

Ulteriori notizie intorno ai Negriti, by Professor Enrico Hillyer Giglioli.

These original papers are followed by reviews of Beccari's "Guide to the Mussulman pilgrimages and the Suez canal," Ramon Lista's "Los Charruas," Giovanni Pelleschi's "Republica Argentina," Ricardi's "L'Attenzione in rapporto alla pedagogia," Nicolosi-Tirrizzi's "Teschio umano Scafo-ultra-dolicacefalo-ortognato," Canestrini's "Anomaly of the Trentini cranium," and Moschen's "Studies in the cephalic and the nasal index." The journal is the official organ of the Italian Society of Anthropology, Ethnology and Compartive Psychology, and therefore, each number contains the minutes for one quarter.

THE AMERICAN ANTIQUARIAN.—The April number of the *Antiquarian*, Vol. III, contains the following papers:

An enquiry into the Identity of the Shawnee Indians. By C. C. Royce.

Ancient Stone Mounds.—Were they objurgatory burial heaps. C. H. Brinkly.

Inductive Metrology. W. J. McGee.

Tribal condition of the American races a clue to the condition of society in Prehistoric ages. By Rev. S. D. Peet.

Correspondence. On the Dakota language.—French footprints in northwestern Wisconsin.

Linguistic Notes (A. S. Gatschet). Wandot. Early Greek History. The Paez language. Thothmes.

Ethnologic Notes. General Reviews.

POLITICO-SOCIAL FUNCTIONS.—Science approaches man from many sides. While the physician directs his attacks against his animal organism, the philologist seeks to master the secret approaches to the source of speech, and the sociologist to surprise him in the very act of organizing his forces. Mr. Lester F. Ward, in the Penn Monthly for May, publishes in full a paper read March 15th, before the Anthropological Society of Washington, on Politico-Social Functions.

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SPITZKA, EDWARD C., M.D. (New York)—Author of a series of pamphlets on the nervous system. Preliminary considerations, Chapter I. The central tubular gray; Chapter II. The higher ganglia of the mid and hind brain.

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## GEOLOGY AND PALÆONTOLOGY.

THE TEMPORARY DENTITION OF A NEW CREODONT.—The nature of the temporary dentition of the *Creodonta* has been hitherto unknown. As this point has an important bearing on the supposed relation of these animals to the *Marsupialia*, I give an account of it as seen in a new genus which has recently come under my observation:

*Trüsodon quivirensis* gen. et sp. nov. *Char. gen.*—Derived from the lower jaw. Probably only three premolars. True molars alike, consisting of three anterior cusps and a heel. The cusps are relatively small and the heel large. Of the former the internal is much smaller than the external, and the anterior is rudimental, being merely a projection of the cingulum. The cutting

edges of the large external cusp are obtuse. The heel is basin-shaped, and its posterior border is divided into tubercles, of which the external is a large cusp. The fourth premolar has no anterior inner tubercle, so that the anterior part of the crown consists of a compressed cutting cusp. The heel has two well-developed posterior cusps. The third premolar has a similar principal trenchant cusp, but a smaller heel. Canines large.

This genus differs from *Herpetotherium* and *Ictops* in the simplicity of its fourth inferior premolar, and from *Stypolophus* and *Deltatherium* in the rudimental character of the accessory anterior cusps of the true molars, as well as in the three premolars. The rudimental anterior cusp of the true molars, with the three similar true molars, separates it from *Palæonyctis*, and the presence of a conic inner cusp of the same indicates it as different from *Amblyctonus* and *Periptychus*. It is not possible to state whether *Triïsodon* must be placed in the *Amblyctonidæ* or not, on account of the absence of the superior molar teeth.

This specimen of the type species of this genus is instructive as showing the succession of premolar teeth. Both the third and fourth premolars have temporary predecessors. The predecessor of the fourth premolar differs much from it in form, and is essentially identical in all respects with the true permanent molars. The crown of the predecessor of the third premolar is wanting, the roots only remaining in the jaw.

The permanent third premolar was protruded before the permanent fourth. Which temporary tooth of *Triïsodon* is homologous with the single one of the *Marsupialia* pointed out by Professor Flower?[1] As the additional permanent teeth of the placental *Mammalia* must have appeared later in time than the one already found in the implacentals, they must be those later protruded; hence the fourth tooth in the jaw of *Triïsodon* must be regarded as homologous with the fourth premolar of a placental, which is the last of that series to appear. If this be true, the tooth which follows the shed tooth of the Marsupials is not the fourth premolar, as supposed by Professor Flower, but the third premolar. This view is confirmed by the fact that the milk tooth displaced by the fourth tooth in *Triïsodon* resembles in all respects the true molars, just as the permanent tooth occupying the same position does in *Didelphys* and some extinct eocene genera. This goes to show that this tooth, permanent in marsupials, is temporary in placentals, and that, in spite of its form in the former group, it is the fourth premolar, and not the first true molar, as supposed by Professor Flower. Thus the posterior milk-molar of diphyodonts is a permanent tooth in the *Marsupialia*.

This observation confirms my conclusion that the *Creodonta* form a group intermediate between the *Marsupialia* and *Car-*

[1] Transactions of the Royal Society, 1867, p. 631.

*nivora.*[1] I may add that in *Triïsodon* the inferior border of the lower jaw is not inflected posteriorly.

*Char. specif.*—Size about that of the wolf. Inferior canine directed upwards, its section nearly elliptic; a faint posterior, no anterior cutting edge. Fourth premolar rather large, with an anterior basal cingulum which is angulate upwards, and is not continued on the inner side of the crown. Cusps of the heel each sending a ridge forwards, the internal lower, obtuse and descending to base of inner side of large cusp; the external larger, with an acute anterior cutting edge continuous with the cutting edge of the large cusp. True molars with an external, but no internal basal cingulum. Border of heel with one large and three smaller tubercles, the former with, the latter without, anterior cutting edge. Enamel of all the teeth nearly smooth. All the cusps are rather obtuse. *Measurements.*—Length of inferior molar series: M. .080; long diameter of base of canine .013; length of true molar series .044; length of base of Prem. IV. .016; elevation of crown of do. .014; length of base of M. II. .016; width of do. in front .011. elevation of do., .014. The measurements of the jaw are not given, as the animal is not adult, the last molar not being yet protruded.

From the lower (? Puerco) Eocene beds of New Mexico.

*Deltatherium absarokæ* sp. nov. *Char. specif.*—This animal repeats very closely the characters of the *D. fundaminis*, but is much smaller in all its proportions. Both branches of the lower jaw accompany the anterior part of the skull, so that the dentition is well displayed. There are three inferior tubercular-sectorial molars, as in *Stypolophus*, but the fourth premolar has an internal tubercle, which is not found in that genus. The same tooth has a rudimental heel. The third inferior premolar is large, has a rudimental heel, and no inner lobe; the first premolar is two-rooted. There are only three inferior incisors. The superior molars are triangular, and the external posterior angle is not produced. The external cusp of the fourth posterior molar is compressed and simple, as in *Proviverra;* in *Stypolophus (Prototomus) viverrinus* and *S. multicuspis*, that tooth has a conic cusp and large posterior heel. The two posterior sides of the last superior molar are equal. Canines well developed. Enamel smooth.

*Measurements.*—Length of superior molar series: M. .0216; of superior true molars .0107. Diameters of second true molars: anteroposterior .0033; transverse .0055; width of jaws at same tooth .022; width between bases of canines .008; depth ramus mandibuli at Prem. I .005; at M. III .009. From the Wasatch Eocene of the Big Horn river; J. L. Wortman.—*E. D. Cope.*

A Laramie Saurian in the Eocene.—It is known that in North America the saurians of the Laramie formation are mostly

[1] See Proceedings American Philosophical Society, July, 1880.

*Dinosauria*, and that principally on this ground the formation has been referred to the Cretaceous series. A genus of uncertain affinity, *Champsosaurus* (*Simædosaurus* Gerv.), has hitherto been regarded as peculiar to the Laramie. In France, however, it has been found by Dr. Lemoine near Reims, in the Suessonian Eocene, associated with *Mammalia*. I am now able to announce that the same association occurs in New Mexico in a formation which lies below the typical Wasatch Eocene, and which may be the Puerco. *Champsosaurus* is found imbedded in the same matrix with species of *Triïsodon*, *Periptychus*, *Hyracotherium*, and a species probably of *Phenacodus*. Portions of a dozen vertebræ were sent me, mingled with the teeth of the last-named mammal, and they appear to belong to one animal, and are unworn. As usual with vertebræ of the Laramie, the neural arches are lost. I describe the new species as follows:

*Champsosaurus australis.* Cervical vertebra distinguished by the superior transverse extent as compared with the longitudinal and vertical. The dimensions are about those of the *C. laticollis*. There is a similar median inferior low keel. The outline of the articular face for the neural arch is pyriform, the wide portion concave, with its external edge decurved. The decurvature is sometimes sufficient to resemble part of a rib-facet. Articular faces of centra nearly plane. Sides of centra very little concave, pierced by a foramen below the base of each diapophysis. Non-articular surfaces of centrum marked with a delicate thread-like sculpture. Diameters of cervical centrum: anteroposterior M. .012; vertical .014; transverse .017. Diameters of a dorsal: anteroposterior .013; vertical .012; transverse .015. The cervical vertebra is wider and more transverse than in either of the four known American species.—*E. D. Cope.*

Colors of Geological Maps.—Professor Renevier, of Lausanne, general secretary of the commission appointed by the Geological Congress of Paris of 1878, to unify the colors of geological maps, makes a report which is published in the Bulletin of the Vaudoise Society of Natural Sciences. Sub-committees were appointed in the following countries: Germany, Spain, Portugal, Russia, France, Italy, Switzerland and the United States. The fullest reports were made by the Italian and French committees, and the colors they suggest are as follows:

| | Italian. | French. |
|---|---|---|
| A. Stratigraphic Series (colors pale). | | |
| Modern beds | White | White |
| Quaternary | Pale green | Pale green |
| Pliocene | Clear yellow | Mars red |
| Miocene | Reddish yellow | Reddish yellow |
| Eocene | Bistre | Pale yellow |
| Cretaceous | Green | Green |
| Jurassic | Blue | Blue |
| Liassic | Violet | Violet |

| | Italian. | French. |
|---|---|---|
| A. STRATIGRAPHIC SERIES (colors pale)—*Continued.* | | |
| Triassic | Burnt sienna | Burnt sienna |
| Permian, Carboniferous | Deep gray | Deep gray |
| Devonian, Silurian | Rose brown banded | Deep brown |
| Crystalline | Rose carmine | Rose carmine |
| B. ERUPTIVE SERIES. | | |
| Granite | Deep carmine | Deep carmine |
| Porphyries | Saturn red | Orange yellow |
| Trachyte | Indian yellow | Indian yellow |
| Serpentine | Deep verdigris | Deep verdigris |
| Diorite | Deep blue | Deep blue |
| Melaphyre | Deep violet | Deep violet |
| Basalt | Deep bistre | |
| Modern lava | Deep red | Orange red |
| Volcanic tufas | Very pale blue | Very pale blue |

GEOLOGICAL NEWS.—Dr. Anton Fritsch's monograph of the Permian fauna of Bohemia, has advanced to the third part, including page 158. He describes the species of *Urocordylus*, *Ceraterpeton* and *Limnerpeton*. There are eleven plates and numerous phototypes in the text.——The annual distribution of the prizes of the Geological Society of London, at its annual general meeting, Feb. 18, 1881, was as follows: The Wollaston gold medal to Professor P. Martin Duncan, M.B., F.R.S., F.G.S.; the Murchison medal to Professor Archibald Geikie, F.R.S., F.G.S.; the Lyell medal for transmission to Dr. J. W. Dawson, F.R.S., F.G.S., of Montreal, by Mr. Worthington W. Smyth; the Bigsby medal to Dr. Charles Barrois, of Lille, to be transmitted by Professor Morris, F.G.S.; the remainder of the Wollaston donation fund to Dr. Ramsay H. Traquair, F.G.S., of Edinburgh, to be transmitted by Professor J. W. Judd, F.R.S., Sec. G.S.; the balance of the proceeds of the Murchison donation fund the president handed to Frank Rutley, F.G.S.; one portion of the moiety of the Lyell donation fund to G. R. Vine, Esq.; the second portion of the Lyell donation fund to Dr. Anton Fritsch, of Prague, by hand of Professor H. G. Seeley, F.R.S., F.G.S., for transmission.——The extensive silver ore deposit in South Western New Mexico recently examined by George Daly, proves to be of Middle Carboniferous age according to Prof. C. A. White. This palæontologist determines the following species as from the adjacent limestone: *Fenestella*, *Amplexus*, *Zaphrentis* and Crinoid species; *Orthis resupinoides* Cox; *O. ? michelini*, *Rhynchonella prolutosa* White.——A recent Cyprinid fish from China, having exactly the dental characters of the American Pliocene genus *Mylocyprinus* Leidy, has been recently described by Peters under a new generic name.

## GEOGRAPHY AND TRAVELS.[1]

EAST CENTRAL AFRICA.—Mr. James Stewart, of the Livingstonia Mission, in a paper read before the London Geographical Society, gives the following account of the seasons and weather on Lake Nyassa:

"The year can be divided into only two seasons, the rainy and the dry. During the last week of October, when the sun is vertical, a few days of rain may be expected, but this is not the beginning of the rainy season. The rains usually begin about the 1st of December on Lake Nyassa. Further north, and at Pambete on Lake Tanganyika, they begin a month earlier, if my experience in 1879 was a usual one. Perhaps there the October rains really mark the beginning of the wet season. The rains last till April, sometimes even into the month of May. At Livingstonia, on Cape Maclear, the average rainfall is about thirty inches. Lying on a promontory jutting northwards into the lake, it is disadvantageously situated to catch the rain. Frequently heavy showers are seen passing down the east and west shores of the lake while Cape Maclear receives not a drop. At our sub-station at Bandawe, two degrees further north, as much as eighty-six inches of rain have been registered, and that in a season which the natives complained of as being too dry. Between May and October there very seldom is any rain. The soil gets dry and parched; the rank grass withers up and assumes the appearance of golden grain in England in July, only, however, to fall before the fiery storms which sweep across the country in September. This want of cold weather rains is a serious hindrance to agricultural operations. European cereals and vegetables cannot be raised without irrigation. In the dry plains of Northern India, Christmas rains and rains in February may be confidently looked for, and on them depends the success of the great wheat crop of the Punjab. Nothing corresponding to them is found in the Nyassa region of Africa.

"With the change of season a change in the direction of the wind occurs, or more correctly the latter is the cause of the change of weather. Winds from the north prevail from November to May, bringing with them the moisture-laden clouds from the Indian Ocean, while during the whole of the dry weather southerly winds prevail. The constancy of those winds is a source of trouble and expense to us. In May, for instance, it is easy and pleasant sailing to go to the north end of the lake, but to return in the same month requires a constant fight with the elements for ten days or a fortnight, taxing our courage as well as our seamanship.

"It is well known that the barometer in tropical countries is not subject to such rapid changes as in northern latitudes. At Livingstonia the annual range is only about half an inch, or from 28.20

[1] Edited by ELLIS H. YARNALL, Philadelphia.

inches in November to 28.70 in June. The diurnal variation is rarely more than twenty hundredths of an inch. The barometer is therefore of little use as a weather glass, but, on the other hand, is more serviceable for geographical work in the measurement of mountain heights.

"The temperature on Lake Nyassa is very equable. The average midday temperature of the hottest month, November, is 85° F., and the average night temperature of the coldest month, May, is about 60°—a range of only 25° throughout the year. Occasionally, however, we have days at 95°, and even 100° has been registered once or twice. At the other end of the scale, 54° has been the lowest. As a general rule the wet-bulb thermometer stands at 10° below the dry-bulb throughout the dry months of the year."

As regards the alteration in level of the waters of Lake Nyassa, the observations made at Livingstonia show that "since 1875 the low-water level of the lake has year by year been falling, till in December, 1880, it was three feet below that of December, 1875. Should this decrease continue, the matter will soon become serious during the dry season with regard to the navigation of the southern end of the lake at the entrance to the Shiré, and still more so at the northern extremity of Lake Pamalombé, which, indeed, would probably soon become another marsh similar to Morambala; and the Upper Shiré, hitherto affording such a good waterway, would have its navigation interrupted by snags and sand-banks, while the *Ilala*, already requiring careful steering among the shallows, would be confined to the lake."[1]

As stated in our April number, the waters of the Tanganyika are falling since the opening of the outlet by the Lukuga. Mr. Thomson, of the recent expedition to these lakes, noticed a difference in the two mouths he passed on the shore of Tanganyika and saw a sill beginning to form at the mouth of the Lukuga. In ordinary seasons, Mr. Thomson thinks, "evaporation and rainfall balance each other, but that during some years there might be an excess of evaporation, which was a very likely thing to happen in such a country, and consequently the lake would fall in level. This clearly accounts for the intermittent character of the drainage. There had been a period of very dry seasons, probably before this century, in which the level of the lake was lowered so that no water went out by the Lukuga. Gradually a change took place; the rainfall became more abundant and the water gradually rose until the barrier was swept away and an outlet once more formed for the surplus water of the lake as they now had it."

Mr. Thomson's narrative of his journey has been published under the title "To the Central African Lakes and back," and contains much of scientific interest. He has a note on the recent great improvement in the climate of Zanzibar, the malaria and

[1] Livingstonia Mission Report for 1880.

general unhealthiness experienced there having practically disappeared; since 1857 the rainfall has diminished one-half and the island is now an ordinarily healthy one.

Botanical and conchological collections are treated of separately in an appendix. Mr. Edgar A. Smith, of the British Museum, states that the shells from Tanganyika indicate that "the lake was formerly an inland sea, whose waters have gradually freshened, many of the species having all the appearance of modified marine forms. Nyassa has apparently no connection with the formation of this lake, as it presents a quite distinct conchological fauna."

Of the geology of East Central Africa, Mr. Thomson says, that the coast tertiary deposits "are succeeded near the base of the inner plateau by sandstones and carboniferous rocks striking north and south, never rising over 1000 feet, and suggesting a continental outline unaltered from an anterior period. An immense series of greatly more ancient metamorphic rocks composes the escarpment of the plateau, after which a granitic district (sometimes decomposed and forming thick accumulations of clay) is reached, showing evidences of volcanic eruptions, which extended from the Cape to Abyssinia parallel to and near the coast. The upper plateau is also metamorphic, clay-slates occurring near Nyassa, round which is an extraordinary agglomeration of volcanic rocks, probably resulting from one slowly acting crater. No sufficient material is given for any broad sketch of the country between Nyassa and Tanganyika. The latter lake is set as it were in a socket of sandstone, which ends abruptly with the descent from the plateau, being succeeded by a great mass of felspathic rock forced through the crust of the earth previous to the formation of the present lake, and subsequently fractured into halves. The beds on the eastern side of the lake seem not to have been much disturbed, and were formed by a great inland sea-basin, which included the whole Congo region from Tanganyika to the West Coast mountains, the lake forming a bottom hollow, remaining salt on the upheaval of the continent. This basin disappeared through the channel cut by the great western outlet of the Congo, or by the more speedy fracture of the Zambesi."

The Algerian missionaries in Urundi, near the northern end of Lake Tanganyika, have founded a station on the west coast of the lake at Mulonewa in the Masansi country, on the shores of the large gulf which Stanley named after Capt. Burton. The country is covered with fine trees. A range of hills separates it in the rear from the Wabembe, who are said to be cannibals.

Père Livinhac, the head of the Algerian Missionary Expedition Uganda, has given some account of the rulers of that country. Under the *Kabaka*, or absolute monarch, are the chiefs of the great families, called *Mohamis*, of whom three members visited England in

the company of missionaries who returned last year. Below these are a class of inferior chiefs. The lowest order are the *Wadu* or slaves. Mtesa is much under the influence of the *Mohamis*, who are mostly opposed to the admission of foreigners into the kingdom.

We learn from the *Mittheilungen* that Dr. Junker returned from his journey to the Monbuttu country to his station in Ndoruma's territory in December last. He crossed the Welle river half-way between Miani's Bakangoi and the former capital of Munza. Near the latter place he saw the grave of the Italian traveler. He returned through Wando's land, crossing the Gadde and Bibali rivers at their confluence. He finally departed from Ndoruma's on the 7th of January for Bakangoi and was last heard from at Pulembata in Baria's country on January 28th.

WEST CENTRAL AFRICA.—Dr. Max Buchner failed in his effort to explore north of the kingdom of the Muata Yanvo. He only reached lat. 7° 22′ S., when the desertion of his porters obliged him to return. He arrived at Malange on February 8th. Most of his collections were on board of a steamer recently lost in the British Channel.

Dr. Pogge, whose visit to the Muata Yanvo six years ago will be remembered, has arrived at St. Paul de Loanda and departed for Dondo.

Herr Flegel, whose trip up the Binué was described in the NATURALIST for September, 1880, has recently been visiting the unknown course of the Niger between Jauri and Say. He found navigation obstructed and frequently rendered impossible by beds of immense boulders, through which the stream forces its way with immense difficulty.

On the Congo some advance has been made by the missionary parties in their progress towards the interior. Mr. McCall's party has safely reached Manyanga, near the right bank of the Congo, above the Yellala falls. This mission has now five stations in the first 200 miles on the Congo, viz.: Banana; Mataddi Minkanda, opposite H. M. Stanley's station at Vivi; Paraballa; Banza Montega; and Manyanga, which is situated a few miles inland from the northern bank of the Congo. Another station is to be established at the mouth of the Edwin Arnold river, some miles higher up than Manyanga. Mr. McCall has determined to proceed to Stanley pool by the river, believing that many and perhaps the majority of the intervening falls and rapids can be passed in canoes. He has already passed one, the Ntombo Mataka falls of Mr. Stanley's map.

Meanwhile the members of the Baptist Missionary Expedition, Messrs. Crudgington and Bentley, have succeeded in reaching the pool by following the north bank of the river. After a journey of twenty-one days they arrived at Mfwa, near Mankoneh's village at Stanley pool. From here they crossed the pool to Ntamo

or Kintamo, where they remained two days, but finding that the natives did not wish them to stop, they went on by land to Nehasha or Kinshasha, where the natives were even worse, owing probably to a misunderstanding. This appears to be the locality of M. de Brazza's station, and notwithstanding all that the French sergeant in charge said, the natives, finding that Mr. Crudgington and his companions were not Frenchmen, could not be persuaded that they were not enemies. They accordingly made the best of their way back to the opposite side of the river and shortly afterwards commenced their return journey, which was accomplished in fifteen days, partly by land and partly by water.

The expedition now proposes, after consultation with Mr. Stanley, to use his road as far as Isangila, his furthest station, thirty miles above Vivi, and then to place a steel boat on the river above the falls at that point. It is hoped that the navigation will be uninterrupted above Isangila, except at two or three places where the boat will have to be taken round the cataracts. Mr. Stanley himself contemplates adopting this course also, as above Isangila is a very troublesome tribe, named Basundi. He has a steam launch and two steel whale-boats above the falls. He is now awaiting the arrival of a reinforcement of seventy-two natives from Zanzibar.

Mr. Richards, of the Livingstone (Congo) Inland Mission, has recently visited two towns, a short distance from Banza Montiko, where no Europeans had hitherto been. One of them he describes as neat and orderly in its arrangement. He heard of others further on and thinks the population of the district larger than was supposed. The people are intelligent but very shy.

Geographical News.—The June number of *Petermann's Mittheilungen* contains a valuable paper by Dr. Herman Ziemer, on the greatest daily rainfall. Four inches of rain in twenty-four hours have been recorded at Breslau, Brussels, Geneva, Trieste, Milan and Genoa. Verviers heads the list of European towns with fourteen inches. Purneah, Bengal, has had thirty-five inches. In the British Isles the greatest registered is 12.5 inches at Portree, in the Isle of Skye.——The Royal Geographical Society have published a General Index to the fourth set of ten volumes of the Society's *Journal*. Also a classified catalogue of the collection of maps. A second supplement to the catalogue of the library will include additions to the end of 1880.——The engineers engaged on the Panama canal find great difficulty in deciding how to treat the Chagres river. An immense dam is proposed to turn the river into a lake with an outlet to the Pacific, but the task would be a gigantic one. The dam would have to be a mile long, over 1000 yards thick at the bottom, 250 at the top, and some 50 yards in height.——A narrative of the journey of Count Bela Szechenyi through India, Japan, China, Tibet and Burmah, by his companion, Lieut. G. Kreitner, is to appear in

thirty parts, illustrated with wood-cuts, maps, etc., and published in Vienna.——Capt. J. E. Sandeman, of the British Indian Survey, has recently sent out a trained native explorer to endeavor to ascertain the source of the Irrawaddy river. He went up the stream in boats to Kacho, lat. 25° 20′, at an elevation of about 1000 feet above the sea. Thence by land he continued on to Mogungpoon Maingkung, lat. 26° 8′, at which place the exploration terminated. The eastern and western branches meet at Ponk-san-poon; the western branch is the largest and is said to rise in the Kanti country. There seems to be no doubt that there is no longer any reason to suppose the Irrawaddy is connected with the Sanpu river of Tibet.——The *Academy* says there are several expeditions preparing to visit the Obi and Yenisei gulfs this season. M. Siberiakoff is fitting out sledges to take supplies to two of his vessels which have been frozen up in the Gulf of Obi during the winter. The steamer *Nordenskiöld* will sail for the mouth of the Yenisei from Gothenberg. A hydrographic expedition is also being formed in Russia to visit the Sea of Kara and Gulf of Obi.

## MICROSCOPY.[1]

The Blood in Hibernation.—In the autumn of 1879, Professor V. Wittich, received twelve living German moles *(Mus montanus)*, in order to investigate the amount of glycogen in the liver during their winter sleep. One animal was killed accidentally immediately after its arrival, and the results obtained on a microscopical examination of the blood, led to an examination of the blood of the other animals, all killed in perfect health, and in all the same appearances were found. One of the animals had died on the journey without signs of disease, although perhaps in consequence of a bite from another animal.

The blood taken from a vein in the peritoneal cavity contained a large number of thread-like moving objects, which moved the blood corpuscles lying near them, and, after diluting the blood with a-half per cent. solution of chloride of sodium, presented an appearance identical with that of the spermatozoa of the frog. These organisms appear to be the same as those described by T. R. Lewis as existing in the blood of healthy rats. They are much larger than the spirilla met with in the blood of relapsing fever. They were found in the blood from various parts, arterial and venous, in every animal. They disappear from the blood as soon as decomposition sets in and the putrefaction-bacteria appear. They were very numerous, ten or twelve being found in every drop of blood, and they furnish a new proof of how large a number of parasitic organisms may exist in the blood without causing any disturbance to the general health. Attempts were made to inoculate guinea-pigs, but in every instance with a negative result.—*London Lancet.*

[1] This department is edited by Dr. R. H. Ward, Troy, N. Y.

MOUNTING STARCHES.—A correspondent of *Science Gossip* advises to mount starch by dredging it through muslin into balsam melted in a test tube over a spirit-lamp. After the air bubbles which will appear have been caused to burst, a little of the balsam is transferred to a slide and covered with a warmed cover-glass, when the starch it contained is found to be evenly distributed, free from air bubbles, and in suitable condition to be viewed by polarized light. Very soft balsam, which requires but little heat, should be used in this procedure, lest the starch grains should be altered by the heat.

NEW MICROSCOPICAL JOURNAL.—The microscope, and its relations to medicine and pharmacy, is the title of the new journal whose publication has been commenced at Ann Arbor, by Professor Charles H. Stowell of the University of Michigan. It is a bi-monthly of thirty-two pages, primarily of a microscopical character, but introducing a considerable medley of medical and pharmaceutical notes. Though very elementary in its character, and designed essentially for beginners, it is sensible and scientific in its tone, and will therefore be of interest to all. The pharmacy department is under the charge of Mrs. Louisa R. Stowell, whose real ability and previous good work in this direction give assurance that her department will be an important as well as prominent feature of the enterprise.

RECENT PAMPHLETS.—Les apparences microscopiques des Valves des Diatomees, par Julian Derby, C. E. Bruxelles, Belgium.

Etudes sur des Coupes de Diatomees (Jutland), par W. Prinz. Bruxelles, Belgium.

On some Impurities of Drinking-water. By Professor W. G. Farlow, Boston.

The condition of the Brain in Insanity. By Theodore Deecke, Utica, New York.

Pseudo Polypi of the Colon. By Surgeon J. J. Woodward, U. S. A., Washington.

SOCIETY NOTES.—The American Society of Microscopists will hold its fourth annual meeting at Columbus, Ohio, commencing on the 9th of August, under the presidency of J. D. Hyatt, of New York. A full and interesting meeting is expected. The local arrangements for reception and entertainment under the auspices of the Tyndall Association of Columbus, will doubtless be of the most satisfactory character.

The American Association for the Advancement of Science, meets at Cincinnati on Wednesday of the following week, August 17th, the subsection of microscopy being under the chairmanship of Rev. A. B. Hervey of Taunton, Massachusetts. During the week of the meetings, the Department of Science and Art of the Ohio Mechanics' Institute, will open a loan exhibition of scientific apparatus, including microscopes, and other optical instruments. It is believed that this exhibition of apparatus and objects illustrating natural history in its various branches and applications, will add greatly to the interest of the meetings. Among the prizes offered are

the following: Gold medal for the best display of microscopes and accessories; silver medals for the best display of optical apparatus, of magic lantern and apparatus for projection, and of microscope slides in set of not less than fifty slides; and honorable mention for the best microscope stand, best object glass, and best polarizing apparatus.

The Rochester Microscopical Society, after an existence of two years, during which time it became the largest organization of the kind in this country, has drawn around it sections in other departments of science, and has thus given origin to a new society of wider scope, the Rochester Academy of Science, of which it will hereafter be a section. The recent annual reception of the new academy was one of the largest and best of such entertainments that have been given in the country.

The ninth annual reception of the San Francisco Microscopical Society was distinguished by the scientific value of the objects selected for exhibition, and by the large and appreciative assemblage of guests. The concourse of friends was said to be the largest that has ever attended a reception of the society.

The exhibition of the Wellesley College Microscopical Society, was remarkable for the thorough scientific character and direct educational value of the exhibits. The microscopical work at this institution is evidently well planned and well executed.

The thirteenth annual field meeting of the Troy Scientific Association, held at Trenton Falls, N. Y., was one of the most successful out-of-town meetings ever held by this society. A large and distinguished party of members and friends enjoyed the rare social advantages and scientific opportunities of the trip.

The Oneida County Microscopical Society has been organized, under the presidency of Professor A. H. Chester. It meets at Utica, N. Y.

The American Postal Microscopical Club has just completed the first year's work since reorganization. Postal troubles are no longer experienced, and with rare exceptions the working of the circuits has been satisfactory. The boxes have been called in for the summer, but will be started again in September or October.

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## SCIENTIFIC NEWS.

— A remarkable cave has been discovered in the Santa Rita mountains, Arizona. For several years the existence of a curious cave near Graterville has been known to the miners of the vicinity, but the difficulty of thorough exploration has deterred many from visiting it, and half of its wonderful extent is as yet unknown. From P. J. Coyne, a well-known and reliable prospector, who is in the city, in company with Mr. Johnson, a *Citizen* reporter, were gathered some interesting facts, the result of a partial exploration.

The cave, which is known by the miners as the Aztec, is located about four miles south of the Graterville placers, in a limestone ridge. Quite recently a party of miners numbering eight or ten, including Mr. Coyne, explored seventeen rooms in all, the corridors and approaches to which extended for nearly a mile from the entrance.

The cave has two entrances, which lead into an oval cavity, thence a corridor leads into a large room, and thence into a still larger. In from the latter are two smaller cavities, and these comprise the extent of former explorations. In them have been found at various times in the past relics of Indian occupation, including arrows and skeletons. In one place several Indian skeletons were found in a depression in the floor of the cave, evidently fashioned by human hands. This latter room is described as being of marvelous beauty. It is irregular in shape, and is full of all the various forms which the action of lime has the power to create. In one of these rooms is a group of almost perfect statuary. It consists of a large block of limestone in the shape of a man, woman and child, the man being in the center, and also having the closest resemblance to humanity. The head is especially like that of a man, having the features almost distinct and surmounted by a hat. A short distance away from the group, in the flickering candlelight, the illusion is said to be absolutely perfect. At this point the cave discloses the strange feature of being two-storied, to reach the lower rooms of which it was necessary to descend by means of ropes. Here the extent of the old exploration cease, and the adventurers had to be careful lest some new and strange feature of the cave cause them trouble. In one of a group of three lower rooms was found a huge stalactite, which was instinctively called Pompey's Pillar. It is three feet in diameter at the base, and lessens gracefully in size to the roof of the cave, thirty feet high. This is probably 600 feet below the surface.

From the rooms last mentioned a corridor leads to a very large and irregular cavity, and from this small corridors lead to very beautiful rooms, which were given the names of different members of the exploring party. The one named for Mr. Coyne is the largest in the cave. From what was called "Hale's room" the party followed a steeply inclined tunnel seventy-five or eighty feet long, which terminates in a large abyss sixty or seventy feet in diameter. After lowering one of the party down the perpendicular sides from the mouth of the tunnel as far as the remaining rope would permit—about seventy feet—and failing to find bottom, the explorers named it the "bottomless pit."—*Tucson Citizen.*

— What is equivalent to a well sustained, energetic and truly scientific biological survey of Illinois, is now being carried on by the Director of the State Laboratory of Natural History, at Normal, Illinois. The appropriations for the year ending June 30, 1880, were $4000, and when it is remembered that the State has

besides a salaried entomologist, it must be conceded that Illinois is leading all the States in the Union in biological work well calculated to elevate, educate and inform the masses. Professor Forbes' able contributions, as well as those of his assistants, have from time to time been noticed in this journal. He is now carrying on the field work, the State being divided into four or five regions. In the appropriation bill passed for the coming year, special provision is made for field work in zoölogy, for field work in botany, for the supply of series of the plants and animals of the State, to the State Museum, the State educational institutions and the public high schools, for the investigation of the food of birds, of the food of fishes and of the parasitic plants and animals of the State, for the improvement of the library and for the publication of bulletins of original work. The laboratory has accumulated the largest collection of fungi in the Western States, the collection embracing 550 species of Illinois, 1000 United States species and 1500 species foreign fungi.

Our readers will see that these subjects are so distributed as to cover directly and indirectly nearly the whole field of the natural history of Illinois.

— The Zoölogical Society of London has, we learn from *Nature*, established an insectarium, or series of rooms for rearing insects in captivity. The building for this purpose is constructed of iron and glass on three sides, with a brick back to it; the cases containing the insects are arranged on stands all round the building, and also occupy two tables in the center. The cases used for the principal specimens are formed of zinc plates. The upper part of these is glazed on all four sides, the top being formed of perforated zinc, so as to admit the air. The larger cases in the front row measure about 24 inches in breadth by 18 in depth, and are 32 inches in height. The cases in the opposite row are of similar construction, but rather smaller in dimensions. The whole series of insects already on exhibition last spring comprised about fifty species, among them the Cecropia moth and *Samia gloveri* of the United States. Every specimen in the insectarium is distinctly labeled, and over each of the principal cases is fixed a glazed box, in which are placed preserved specimens of the various stages of metamorphosis of the insect exhibited in the case beneath.

— The tendency in our colleges is more and more towards the cultivation of the sciences of observation, to found separate chairs of natural history, and not to require a single professor, as of old, to teach physics and chemistry, as well as geology and biology. In proof of this statement, we notice that Hon. John P. Howard has endowed a professorship of natural history in the University of Vermont. The fund of $50,000 thus given to be applied in part for museum and library purposes. At Brown University, Mr. W. W. Bailey has been appointed Olney professor

of natural history, the duties being instruction in botany. A generous friend of the University is also providing a roomy laboratory, lecture room, study and store room for the use of the professor of zoölogy and geology. At Bowdoin College, Mr. Leslie A. Lee has been appointed professor of geology and biology. Dr. S. F. Clarke, late Fellow of Johns Hopkins University, has been appointed professor of natural history at Williams College; an appointment for which the College is to be congratulated.

— Professor Cope's expedition to Paraguay, known as the American Naturalist Expedition, left New York for Para, May 1st. The survey has a wide scope, covering many of the natural features of the regions to be examined. It is under the direction of Mr. Herbert H. Smith, formerly of the Geological Survey of Brazil, under Professor C. F. Hartt, and the author of a scientific volume on Brazil, published by the Scribners. The expedition is the individual effort of Professor Cope.

Mr. Smith will act as regular correspondent to the NATURALIST, describing the regions explored. We anticipate that his notes on the fauna and flora will be particularly interesting. The survey is fully equipped with means to preserve a full supply of material, which will be utilized upon reaching Philadelphia, and will throw much light on some little known regions of South America.

— Holt & Co., of New York, have in press a book entitled The Structure and Life-histories of Butterflies, by S. H. Scudder. It relates particularly to American butterflies, and is mainly a reproduction of lectures given several years ago before the Lowell Institute. It deals with the general problems suggested by a study of the structure, development, seasons, distribution and coloring of butterflies from an evolutionary point of view, and will discuss more fully than has heretofore been attempted, the ancestry of this group of insects. Nearly three quarters of the two hundred illustrations have been prepared for the work, while the others are borrowed principally from Harris and Riley.

— A work of extensive anatomical research on the cerebellum in various animal species has been conducted recently by two Italians, Drs. Tenchini and Staurengi. From a résumé of it in the *Archives des Sciences*, we gather that it establishes three important features as the exclusive possession of man, viz., the valves of Taria, a new tubercle in the arch of the fourth ventricle, and the ventricle of Verga. These are considered characters of prime importance as being related to the nervous system; and with others, they show, that if the anthropoid apes are the vertebrates nearest to man, the distance between man and the ape is still very great.

— A paper was read at a recent meeting of the Chemical Society on the action of compounds inimical to bacterial life, by

Mr. W. M. Hamlet. The cultivating fluids used comprised Pasteur's fluid, beef-tea, hay-infusion, brewer's wort, and extract of meat; these were sterilized by boiling for ten minutes in Pasteur's flasks, cooled with suitable precautions, and then seeded with hay solution and the substance under examination added. Many gases, &c., were tried. Chlorine and hydric peroxide were fatal to bacteria, while chloroform, creosote, carbolic acid, salicylic acid, &c., hindered their development, but did not destroy them.

— The appointment, by President Garfield, of Hon. George B. Loring as Commissioner of Agriculture, has been regarded on all sides as peculiarly fitting. It is a new departure to have a commissioner who is not only a gentleman of broad culture, but one who sympathizes with scientific men, and will, undoubtedly, encourage, as no former commissioner has done, the development of applied botany and zoölogy, particularly entomology. As an earnest of his intentions in this direction, the commissioner has appointed Professor C. V. Riley entomologist of the department, in place of Professor Comstock, resigned.

— We learn from the *Nation* that the International Congress of Americanists will be held at Madrid, Sept. 18–22. The first day will be devoted to American geology, the history of Pre-columbian times, and the history of the discovery; the second day to archæology; the third to anthropology and ethnography; the last to linguistics and palæography. The general secretary is Captain C. F. Duro Sauco 13 duplicado, Madrid. The programme, list of officers, delegates, etc., has been issued by M. G. Hernandez, of Madrid.

— We have received Bulletin 4 of the Illinois State Laboratory of Natural History, comprising a catalogue of the birds of Illinois, by R. Ridgway. This list will be of use in the more important biological work carried on in this institution, which is a great credit to the state, and will do much to turn naturalists away from "species work" and induce them to study the relations of animals to one another, and to their physical surroundings.

— The International Geological Congress is to hold its second session at Bologna, commencing on Sept. 29, 1881. The King of Italy has offered a prize of 5000 francs for the best suggestion for an international scale of colors and conventional signs practically applicable to geological maps and sections, including those of small scale. The competitive papers were demanded by the end of May.

— Near Lützen, in Saxony, a number of sepulchral urns have been discovered in a brickfield, and accompanying them skulls and bones, showing that cremation and burial were both practiced by the depositors. Professor Virchow says that one of the skulls he has examined resembles the Neanderthal skull, but differs

sufficiently to form a type of its own. No ornaments were discovered.

— Mr. Charles Darwin's work entitled "The Formation of vegetable Mold through the action of Worms, with Observations on their Habits," and the life and letters of the late Sir Charles Lyell, Bart., edited by his sister-in-law, Mrs. Lyell, are announced by Mr. Murray.

— It was probably before Carlyle mollified his views concerning evolution and science, owing possibly to the influence of his friend, Professor Tyndall, that he paid his respects to the theory in the following terms: "I have no patience whatever with these Gorilla Damnifications of Humanity!"

— The Italian government is about to send out a deep-sea expedition to explore the Mediterranean, Prof. Giglioli, the eminent zoölogist of Florence, having charge of the biological part of the work.

— The translations of Nägeli and Schwendener's Treatise on the Microscope is approaching completion. It will be issued by Sonnenschein & Allen, of London.

— English science has met with a great loss in the untimely death of Professor George Rolleston, F. R. S., of Oxford University, who died at his home June 16th, at the comparatively early age of 51 years. Professor Rolleston was, to those who knew him, a most genial, attractive and cultivated man, aside from his thorough scientific spirit and training. He was the author, besides of a number of anatomical and anthropological papers and memoirs, of a comparative anatomy for students, entitled, "Forms of Animal Life." Professor Rolleston first introduced, if we mistake not, the plan of giving detailed accounts, with excellent illustrations, of typical forms of animal life. The death of Professor Rolleston will be deeply mourned by those American scientists who were fortunate enough to have met him at his museum and also at his pleasant English home.

— Another English naturalist, Mr. John Blackwall, died May 11, at the great age of ninety-two. He was the author of a beautifully illustrated folio work on British spiders, and of a number of zoölogical papers.

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## PROCEEDINGS OF SCIENTIFIC SOCIETIES.

DAVENPORT ACADEMY OF NATURAL SCIENCES.—Annual Meeting. Our report of the annual meeting of this flourishing society has been delayed for want of space. We give extracts from President Pratt's report as to the part taken by the Society in American archæology, especially as related to the mound-builders.

The mound-builders were very numerous throughout the Mississippi valley. They dwelt mostly, if not exclusively, in the

neighborhood of the rivers. They were a people entirely distinct from the North American Indians, as we know them, had occupied the country in much earlier times than the latter, and were entirely unknown to them, even by tradition.

Like the modern Indians they were of different tribes; but less warlike and less nomadic, more domestic in their habits; yet their dwellings must have been of the most imperfect and perishable character, no traces of them being found.

They practiced cremation, though but to a limited extent, and only upon great and unusual occasions.

They lived in a very simple manner, possessed few mechanical contrivances, but were a laborious, pains-taking people. That they had some system of barter with neighboring tribes at least (though perhaps limited to mere occasional exchanges as opportunity offered) is shown by the occurrence in the mounds of large sea shells, which, at the nearest must have come from the Gulf of Mexico; obsidian which must be from the far west, mica, not to be found in this region; galena, &c.

Copper was evidently a rare and highly valued article among them; its rarity seems to indicate that they at least did not work the copper mines of Lake Superior or anywhere, and were not much in communication with any people who did.

Small nuggets of drift copper are still occasionally found here, we have several in our museum, picked up in this vicinity; and a numerous people dwelling here for a long period would be likely to find the greater portion of all such specimens existing here, and if they did so, that would furnish a quite sufficient source of supply of material for all the copper relics yet discovered without the necessity of drawing upon the mines. That the mound-builders had no knowledge of the art of smelting is well shown by the following facts:

The numerous copper axes, awls, beads, &c., and the very rare silver ornaments are evidently of the pure native metal and *hammered*, none are found bearing the slightest indications of having been melted; no molds or crucibles, or fragments of any have ever been found, although they would be of the most imperishable character, more so even than the pottery which is exceedingly common.

If cast in molds, many would be made of identical size and form, whereas no duplicates are ever found.

If, as has been argued, though I believe on very insufficient grounds, the copper implements collected in Wisconsin exhibit indications of having been formed in molds, it would have no bearing whatever upon the origin of those of Iowa, which are of very different type; those of the north being mostly of the more modern forms of spears and knives; and not unusually found in mounds, but scattered on the surface or in the shallow Indian graves.

The copper "axes," so called (and very inappropriately, too), in no instances show any indications of having been put to any use as tools, or even of having had handles attached. They were doubtless valued and kept as badges of rank or wealth, and held in high esteem.

Those people undoubtedly smoked tobacco, not, however, as a recreation or habitually for pleasure, but as a kind of ceremonial observance. The pipes are often very elaborately and beautifully carved out of a great variety of kinds of stone, generally of a rather soft character, and were apparently held in very high estimation, perhaps almost sacred. They are all in the Upper Mississippi Valley, of the same general type, having the flat, curved base, which is perforated to serve as a stem and not at all adapted to retain in the mouth for smoking continuously; which fact, with the smallness of the bowl itself, would indicate that it was to be used by passing from one to another of the persons assembled.

They represent a great variety of animal forms, some difficult to determine, but among them are two, well and distinctly representing the elephant, though differing somewhat from each other in form and position. These plainly and unmistakably show that the sculptors were acquainted with the elephants (the mammoth or mastodon), of which, though long extinct, numerous remains are found throughout this country.

Strangest of all, and most contrary to the opinion of archæologists hitherto, it now appears that *the mound-builders had a written language.* Whence derived, or what its origin is matter of the merest conjecture. What its affinities, or whether any connection with other written languages, ancient or modern, no one has as yet been able to determine.

The inscribed tablets in our museum, the only ones of much significance or importance perhaps, which have as yet been discovered in the mounds, have attracted much attention both in this country and in Europe, and by all eminent and well informed archæologists, are considered of the highest importance. They are certain to stimulate research, which will doubtless lead to further discoveries, until it may well be hoped that the key to the language may ultimately be discovered, and something of a history of this ancient people may be made out as written by themselves.

Whether the language was understood by all, or only by a more learned few, or whether these tablets were heirlooms and cherished relics, cannot now be scarcely even guessed.

A rather significant circumstance, perhaps, is the fact that in the same mound with the two tablets first found, were the bones of a young child, partially preserved by the contact of a large number —about 300—copper beads, indicating it to be an important personage, and that persons of high rank were buried there.

Some doubts of course have been expressed regarding the

genuineness of the tablets, though not to any great extent by competent and candid archæologists, and we feel no uneasiness on that account.

The tablets have been sent to the Smithsonian Institution for examination, and were retained there and subjected to the most thorough scrutiny for two months, during which time the National Academy of Sciences held its meeting there, and the heliotype plates of them were obtained under the directions of Professor Baird himself. They were also exhibited throughout the sessions of the meeting of the American Associations for the Advancement of Science at Boston last August.

Any author or other person who cared to inform himself of the facts, has, and has always had ample opportunity to do so, and would at once see that the circumstances of the finding were such as utterly to preclude all possibility of fraud or imposition.

The evidence that they are coëval with the other relics, that is, that they were inhumed with them and before the mound was built, is ample and conclusive and will be so considered by any unbiased mind.

No prehistoric relic ever found has better evidence to establish its genuineness than these, and not one suspicious circumstance in connection with them has been pointed out, nor can there be.

We shall confidently hope for and gladly welcome further discoveries by whomsoever made tending to throw more light upon this still obscure and intensely interesting problem, of our earliest predecessors on this continent.

Among the principal additions to this department of the museum since the last annual report, have been fourteen mound-builders' pipes, three copper axes, and a number of other relics from the mounds, secured chiefly by the untiring exertions of our honored associate, the Rev. Mr. Gass, who has spared no time or labor, and who has recently presented his report of the exploration of 75 mounds within the year, only one-fifth of which afforded any relics for the museum, though the investigations are always instructive, and many facts are thus learned.

Besides this gratuitous labors and personal expenses borne by himself, about $70 made up by private contribution has been expended for hired help in opening the mounds; the results have been highly satisfactory; and this important work should be continued, and, if possible, better provided for by some regular appropriations. The time is rapidly passing during which the opportunity for such researches in this vicinity will remain.

We have also received as the product of the persistent enthusiasm of Capt. W. P. Hall about 1100 ancient stone and flint implements, and 150 vessels of ancient pottery, the latter having been exhumed by his own hands from the mounds and ancient burial places of the lower Mississippi valley.

Our collection of mound relics now consists of the four in-

scribed tablets, 32 mound-builder's pipes, 25 copper axes, 300 copper beads, 14 copper awls, and a great number and variety of other relics from the mounds of this region, constituting the most extensive, rare and unique collection of its kind in this country and probably in the world.

Besides these, this department contains 225 vessels of ancient pottery, over 1000 stone implements, and 10,000 of flint, beside about an equal number of broken ones and fragments worth preserving.

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## SELECTED ARTICLES IN SCIENTIFIC SERIALS.

AMERICAN JOURNAL OF SCIENCE, July.—Restoration of *Dinoceras mirabile*, by O. C. Marsh. Observations on the structure of Dictyophyton and its affinities with certain sponges, by R. P. Whitfield. Later Tertiary of the Gulf of Mexico, by E. W. Hilgard (with valuable colored map). Turquois of New Mexico, by B. Silliman.

GEOLOGICAL MAGAZINE, June.—Subsidence and elevation, by J. S. Gardner. The mammoth in Europe, by H. H. Howorth.

ANNALS AND MAGAZINE OF NATURAL HISTORY, May. — Male eels compared with the females, by C. Robin.

June.—On the originally bilateral character of the renal organ of Prosobranchia, and on the homologies of the yelk-sac of Cephalopoda, by E. R. Lankester.

ARCHIV FÜR MIKROSKOPISCHE ANATOMIE, March 8.—On the distribution of phosphorescent organs in fishes, by B. Solger.

ZEITSCHRIFT FÜR WISSENSCHAFTLICHE ZOÖLOGIE, June 14, 1881.—The structure of the stigmata in insects, by O. Krancher (elaborately illustrated). Revision of the Holothuria of Mertens-Brandt, by H. Ludwig. On fish psorosperms, by O. Bütschli. Studies on the Bopyridæ, by R. Kossmann.

ANNALS DES SCIENCES NATURELLES, February.—On a new and very small species of Crocidura from Madagascar, by M. Trouessart. Memoir on the birds of the family Megapodiidæ, by M. Oustalet. Memoir on the disposition of the cervical vertebræ in the Chelonians, by L. Vaillant.

CANADIAN ENTOMOLOGIST, June.—Description of the preparatory changes of *Papilio palamedes* (calchas), by W. H. Edwards.

PSYCHE, organ of the Cambridge Entomological Club, January. —On the number of molts of butterflies, with some history of the moth, *Callosamia promethea*, by W. H. Edwards.

PAPILIO, organ of the New York Entomological Club, June.—On *Pieris bryoniæ*, and its derivative forms in Europe and Asia, by W. H. Edwards.